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# USSR Report

CHEMISTRY

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USSR REPORT  
CHEMISTRY

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## ADSORPTION

UDC 546.212

### WATER CONCENTRATION IN SURFACTANT MONOMOLECULAR LAYERS ON WATER SURFACE

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 60, No 9, Sep 86  
(manuscript received 30 Sep 85) pp 2330-2331

[Article by I. V. Myagkov]

[Abstract] A thermodynamic study was conducted on the concentration of water in surfactant monolayers at water-gas interfaces, based on an analysis of the effects of surfactant monolayer on the evaporation of water as published in the literature. The concentration of water in the monomolecular layers was found to depend on the nature of the surfactant, the microstructure of the monolayer, its phase composition, and surface tension. The resultant data are summarized in tabular form, demonstrating that for hydrophobic end groups  $-\text{CH}_3$ ,  $-\text{CBrH}_2$  and  $-\text{CF}_3$  the surface concentration of water as a fraction of the monomolecular layer was equivalent to, respectively, 60, 900 and 1600 per normal vapor saturation of  $1.73 \times 10^{-2} \text{ kg/m}^3$ . Tables 1; references 6: 5 Russian, 1 Western.

12172/12955  
CSO: 1841/54

UDC 537.534.8

### ADSORPTIVE PROPERTIES OF Ge(111) SURFACE AFTER IONIC BOMBARDMENT

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 60, No 9, Sep 86  
(manuscript received 5 Feb 86) pp 2355-2356

[Article by A. S. Yanovskiy, A. P. Simonov and A. M. Panesh, Scientific Research Physicochemical Institute imeni L. Ya. Karpov, Moscow]

[Abstract] Thermodesorption mass-spectrometry was used in a study on the effects of  $\text{Ar}^+$  bombardment of Ge(111) surfaces on the adsorption of hydrogen. Control studies showed a maximum peak at 620 K, with desorption involving molecular hydrogen with an energy of activation of 1.5 eV and a pre-exponential constant of  $8.5 \times 10^{-2} \text{ cm}^2/\text{sec}$ . Bombardment with  $2 \times 10^{16} \text{ Ar ions/cm}^2$

resulted in the appearance of two additional desorption peaks at 550 and 700 K, both with energies of activation of 1 keV. Both peaks were characterized by second order desorption kinetics. The spectral data were interpreted to indicate that the 550 K hydrogen desorption peak was due to modification of the Ge(111) surface as a result of dispersion of the surface layer of Ge atoms. The appearance of the 700 K maximum was ascribed to penetration of AR atoms into the superficial crystalline lattice of Ge atoms. Figures 2; references 8: 2 Russian, 6 Western.

12172/12955  
CSO: 1841/54

UDC 541.183.022+541.183.5

#### ADSORPTION OF PHTHALOCYANINES OF ALUMINUM AND SILICON ON OXIDE CARRIERS

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 60, No 10, Oct 86  
(manuscript received 13 Jan 86) pp 2631-2633

[Article by S. A. Borisenkova, T. Ye. Klimova and V. M. Mokshin, Scientific Research Institute of Organic Intermediate Products and Dyes, Moscow]

[Abstract] There is great interest in a study of the ordered layers of porphyrin-like molecules in connection with the possibility of modeling processes of photosynthesis and creating highly effective solar energy converters. The production of ordered structures of porphyrin-like complexes on carriers is also of interest in connection with the creation of new catalytic systems. The present series of experiments dealt with controlled production of flat ordered monolayers on oxide carriers by the formation of a bond between polar adsorption centers and axial ligands of unsubstituted phthalocyanine complexes. The studies showed that, in the process of formation of adsorption layers of phthalocyanines, the Pc-Pc intermolecular interaction is decisive, determining the kinetics of the process and the structure of the layer in almost all cases. As a result of this, on the surface of the adsorbent, the molecules are placed in linear associates in which the planes of the phthalocyanine molecules are slanted with respect to the surface. The only process competing with the intermolecular interaction is the interaction of the macrocyclic phthalocyanine molecule ligand with the aromatic surface of thermally graphitized carbon black. Only in this case can adsorption layers with flat placement of phthalocyanine molecules be produced. Figure 1; references 8: 7 Russian, 1 Western.

6508/12955  
CSO: 1841/28

## ADHESION OF AQUEOUS SOLUTIONS OF SURFACE-ACTIVE SUBSTANCES (HOMOLOGOUS SERIES OF SODIUM ALKYL SULFATES) TO SOLID SURFACES

Ivanovo IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA  
TEKHNOLOGIYA in Russian Vol 29, No 8, Aug 86  
(manuscript received 13 Feb 85) pp 66-71

[Article by A. A. Abramzon and L. V. Toropina, Chair of Colloid Chemistry,  
Leningrad Institute of Technology imeni Lensovet]

[Abstract] A study is presented of the regularities of wetting and adhesion of aqueous surfactant solutions on solid surfaces. The variation in surface tension, wetting angle and adsorption of solutions of sodium alkyl sulfates as functions of concentration were studied in a liquid-solid system using surfaces of various polarities. Teflon, paraffin, glass, quartz and sapphire surfaces were studied. The work of adhesion for both the low energy and the high energy surfaces was found to be determined by the minimum interaction, while the separating surface, which determined adhesion, passed through the point of weakest interaction. Free surface energies were found to agree well with adhesion obtained by other methods. Figures 4, references 6: 5 Russian, 1 Western.

6508/12955  
CSO: 1841/26

UDC 613.2:678.744:543.8

METHOD OF DETERMINING DICYANDIAMIDE IN WATER

Kiev KHIMIYA I TEKHOLOGIYA VODY in Russian, Vol 8, No 4, Jul-Aug 86  
(manuscript received 14 Jun 83; in final form 16 Aug 85) pp 86-87

[Article by I. S. Dukhovnaya, All-Union Scientific Research Institute of  
Hygiene and Toxicology of Pesticides, Polymers and Plastics, Kiev]

[Abstract] Dicyandiamide was determined in water using thin-layer chromatography on silufol plates or a thin layer of silica gel using a reagent consisting of a mixture of 10% solutions of sodium nitroprusside, potassium ferricyanide, caustic soda and water (1:1:1:3). To select conditions for determination of the compound, its chromatographic behavior was studied in various mobile phases. Achievement of satisfactory sensitivity in determination of dicyandiamide in water requires preliminary concentration of specimens. Evaporation in a water-jet pump vacuum in a water bath at 35-40°C, pH 6-7, was successful. Extraction with chloroform or ethyl acetate was not successful. References 3: 2 Russian, 1 Western.

6508/12955  
CSO: 1841/70



UDC 539.199

PHYSICAL-CHEMICAL STUDIES OF MEMBRANE-TOXIC EFFECTS OF AMINAZINE AND OF SERIES OF ANTIDEPRESSANTS

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 60, No 10, Oct 86  
(manuscript received 15 Jan 85) pp 2527-2534

[Article by N. M. Kocherginskiy, I. S. Osak and Yu. Sh. Moshkovskiy, Institute of Chemical Physics, USSR Academy of Sciences, Moscow]

[Abstract] Aminazine (chlorpromazine) is a widely-used neuroleptic. Many antidepressants act like aminazine, inhibiting membrane ATPase and affecting membrane structure and viscosity. Long-term clinical use of these substances may result in undesirable toxic side effects. The authors studied the influence of high concentrations of these agents on ultrafilters 0.01 cm thick, impregnated with lipid-like substances. It was shown that the impregnated ultra-filters can be used as a satisfactory model of biological membranes to study the physical and chemical properties of the membranotropic side effects of aminazine and a number of antidepressants. Figures 5, references 52: 10 Russian, 42 Western.

6508/12955  
CSO: 1841/28

UDC 541.69

PHYSICAL CHEMICAL MODELS OF RECOGNITION OF CHEMICAL STRUCTURES BY NATURAL SYSTEMS

Kiev TEORETICHESKAYA I EKSPERIMENTALNAYA KHIMIYA in Russian Vol 22, No 4, Jul-Aug 86 (manuscript received 3 Jul 85) pp 450-463

[Article by O. A. Rayevskiy, Institute of Physiology of Active Substances, USSR Academy of Sciences, Moscow Oblast]

[Abstract] An original cybernetic approach based on pattern recognition has been developed, allowing selection of common structural elements in

compounds causing common features of biological activity. This article presents a quantitative description of the recognition process which occurs in natural systems, indicating that the creation of quantitative physical-chemical models of recognition requires data on the capability of various electron donor and acceptor centers for interaction. Knowledge of the electron donor and acceptor factors allows prediction of the enthalpy of complex formation with optimal spatial positioning of the reaction centers. Shielding of a reaction center may result in a significant reduction in  $\Delta H$ . The influence of the entropy factor on recognition processes and the significance of spatial orientation of active centers in recognition of molecules are discussed. The process of recognition may be significantly influenced by the mutual orientation of unshared electron pairs of donor atoms and electron acceptor centers in substrate-receptor complexes. The "key-lock" principle can therefore be applied not only to interacting atoms, but also to their orbitals. Figures 3; references 71: 31 Russian, 40 Western.

6508/12955  
CSO: 1841/17

UDC 541.183:547

#### SYNTHESIS AND CATALYTIC PROPERTIES OF CESITE

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 60, No 9, Sep 86  
(manuscript received 6 Mar 85) pp 2308-2310

[Article by O. A. Mulina, N. F. Meged, N. N. Krupina and I. V. Baranova,  
Grozneyy Petroleum Institute imeni Academician M. D. Millionshchikov]

[Abstract] A cesium zeolite, cesite, was prepared by the crystallization of Na-aluminosilica gel seeded with amorphous Na-Cs-aluminosilica gel, containing 0.23 wt%  $\text{Cs}_2\text{O}$  in the reaction mixture. Retention of the mixture at 95-100°C led to separation of the mother liquor and growth of zeolite crystals confirmed by x-ray analysis to correspond to cesite structure. Cesite was tested for its catalytic efficiency in the conversion of n-butane at 600°C, with yields in the 26.4 to 47.0 wt% range. The yield of  $\text{C}_2\text{-C}_4$  olefins ranged from 15.3 to 21.1 wt%, with the major portion ascribed to propylene (8.3-12.2 wt%). References 2 (Russian).

12172/12955  
CSO: 1841/54

MICROPROCESSOR-BASED EXTRUSION CONTROL IN POLYETHYLENE PROCESSING

Kiev KHIMICHESKAYA TEKHNLOGIYA in Russian No 5, Sep-Oct 86 pp 50-54

[Article by I.Ya. Voronetskiy, B.V. Tikhonov, V.A. Pakharensko, N.V. Krivoshey and V.V. Malinovskiy: "Microprocessor-Based Extrusion Control in Polyethylene Processing"]

[Text] The expanding range of applications of plastic materials in various industries and the progressively more stringent requirements of product quality face specialists in polymer processing and equipment designers with the issue of improving the accuracy of measurement of production process parameters and quality control of industrial processes. Solution of these problems will help improve product quality, achieve higher technical and economic indicators and reduce the operating personnel.

Systems regulating and controlling the extrusion process constructed on the basis of analog regulators operate as local-action regulators (temperature, pressure and worm rotation speed regulators). The construction of complex automated control systems requires the use of complex, cumbersome and expensive analog systems operating with rigid programs. Introduction of microprocessor technology makes it possible to control the industrial process parameters and maintain the complex relationships between these parameters. The programming flexibility, precision of surveillance and control, the simplicity of adjustment and also the continually declining cost of microprocessors will all contribute to total automation of the extrusion process without any human intervention [1]. In order to create highly efficient systems of control, a mathematical description of the extrusion process is necessary as a basis for developing the appropriate control algorithms and programming software.

Before a mathematical description of an object can be created, the industrial process concerned should be described in exact terms and, in particular, with specification of the following criteria and characteristics of the process: the type of material being reworked, its rheological properties, the admissible temperature variation range, the pressure and rotational speed of the extruder worm, the necessary

temperature homogeneity of the melt, the equipment productivity and the interaction of all these parameters, i.e., a knowledge of how the parameters affect each other [2]. Simplified physical and mathematical models have been developed to describe the process of extrusion which typically operates with distributed parameters based on equations of continuity, moments, energy balance, etc. Best results, however, are obtained with physical modeling which takes into account the mechanisms of the process and the interactions of the variables at work. The objective in this case is to give a complete characterization of the process of extrusion of polymer products.

The process of extrusion is characterized by a transfer function linking the variation of the worm rotation speed with the temperature and pressure of the melt on the head. On the basis of the resulting mathematical description of the process, algorithms of production line control are developed. The objective of control is optimizing the plant operation. The optimum criterion may vary depending on the specific requirements, such as maximum output, best product quality, minimum energy consumption, operation with minimum tolerance of size characteristics, etc. [3].

In addition, with microprocessor-based control it is possible to achieve complete repeatability of the industrial process and, when necessary, to rapidly readjust it to new process protocols, a different product mix or a different material.

The system can store dozens of different programs in its memory, and, when necessary, any of these programs can be selected in accordance with the desired industrial process protocol. For controlling the industrial processes, a reliable system of measurement data acquisition is necessary. Special attention should be given here to precision, reproducibility, reliability and long service life of the sensors of the characteristics being measured.

Computerized systems of extrusion plant control should be organized according to a hierarchical principle (fig. 1) [4]. Figure 1 shows an extrusion line control system for production of polyethylene film tubing: WP is worm press; F is filter; H is head; DD is drawing device; WD is winding device; Fn is fan; G is local regulator of compressed air (gate); OCD is device for communication with the object; OC is operator console; GVT is graphic video terminal; ANP is alphanumeric printer;  $t_i$  are temperature sensors;  $T_i$  are local temperature regulators; P are melt pressure sensors;  $\eta$  is melt viscosity sensor;  $\delta$  is film thickness sensor; S is tubing width sensor;  $l$  is sensor of the film length in a roll;  $\omega_i$  is speed sensor;  $N_i$  are local drive regulators; d is double diameter sensor; and  $\kappa$  is sensor monitoring the crystallization line. Sensors monitoring the industrial parameters of the control object are at the bottom level. At the next stage are local regulators (analog-digital or digital) of the main parameters: wall temperature of worm press cylinder, temperature of the shaping tool, worm rotation speed, receiving device motor speed, the tension of material when wound on a roll, etc. Sometimes local regulators

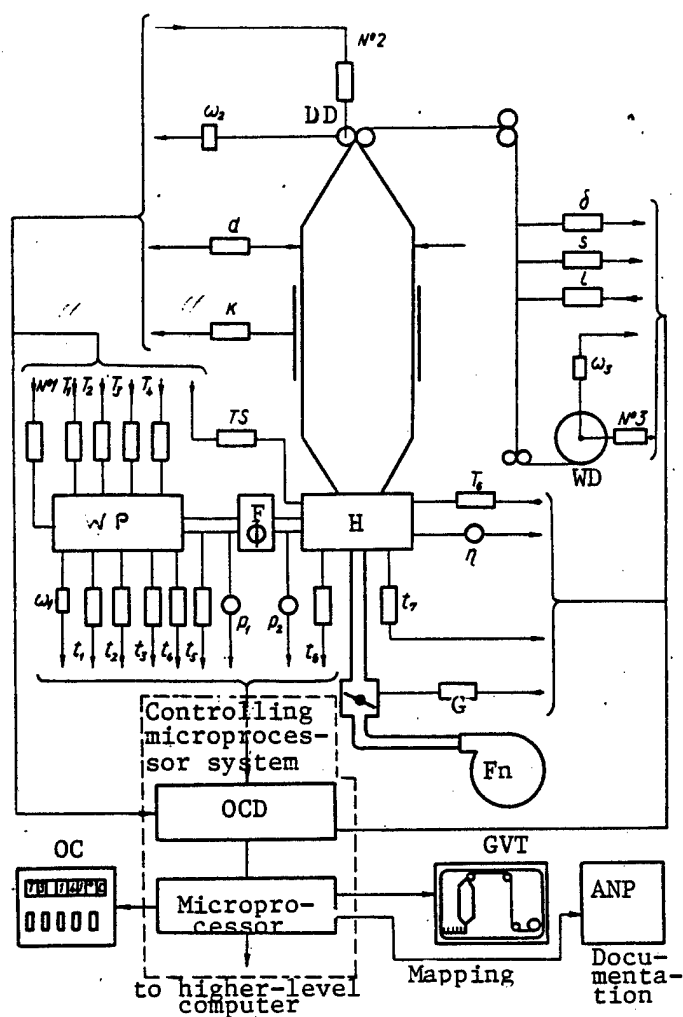


Figure 1

of melt pressure in the head are also used. The next stage is one of microprocessor system of production line control, which coordinates the operation of all local regulators according to the program specified. At the top level is the department or plant mainframe computer controlling the operation of the entire plant in the shop.

The process of extrusion working with polymers and, in particular, polyethylene, can be controlled by a microprocessor only after a preceding investigation of the properties of the polymer in static conditions and determining the optimal parameters of its processing which must be regulated to obtain high physical-mechanical and other properties of the end product.

Taking account of the specifics and the large capacity of some plants, it is interesting to consider the evaluation of the melt quality and optimization of the process of extrusion of polyethylene film. Among the more widespread polymer materials in film production is polyethylene with melt flow indicator (MFI) from 1.5 to 2.0 g/10 min. An evaluation of the polyethylene melt quality for processing is preceded by its investigation in static conditions. For polyethylene this includes evaluating its MFI; the relation linking the shear stress ( $\tau$ ) and viscosity ( $\eta$ ) with the velocity gradient ( $\dot{\gamma}$ ) in a broad temperatures range; the melting temperature; the density and the regularities of evolution of thermal and thermal-oxidative destruction.

Quality melts can be produced only by ensuring optimal processing parameters with which for a fairly long period of time (commensurable with the maximum time of polymer stay in the machine) no mechanical or thermooxidative destruction of polymer takes place and the physical-mechanical properties of film remain stable in a broad range of variation for the large-capacity production, in conformity with the USSR State Standard requirements [5]. The melt quality estimated in the transient zone between the worm and the extruder head depends on the temperature, temperature gradient, pressure and viscosity. The parameters of production of film from polyethylene at high pressures are optimized with respect to the following film characteristics: molecular-mass distribution (MMD), opacity, thickness variations, ultimate tensile stress and relative elongation at rupture.

In particular, optimal melt temperature for production of film from polyethylene 15802-020 is 453 K [6]. At this temperature polyethylene film with stable and high physical-mechanical characteristics is produced in a wide worm rotation speed range. Melt temperature variations for this polymer around 453 K are admissible within  $\pm 5$  K. A larger temperature fluctuation introduces instability into the production process, reducing the plant output and worsening film quality.

The conditions of processing of 15802-020 polyethylene in the production of film with standard commercial single-worm press is determined by the following process parameters: melt temperature, 453 K  $\pm 5$ ; mean speed gradient,  $10^2 - 2 \times 10^2 \text{ s}^{-1}$ ; maximum speed gradient in the clearance between the flight ridge and the cartridge ( $\dot{\gamma}$ ),  $2.5 \times 10^3 - 3 \times 10^3 \text{ s}^{-1}$ ; and the range of effective viscosities at 453 K from  $1.0 \times 10^3$  to  $8.0 \times 10^2 \text{ Pa s}$ . Since the rheologic conditions (the viscosity range of  $1.0 \times 10^3$  to  $8.0 \times 10^2 \text{ Pa s}$ ) of the polyethylene film formation by extrusion should be identical, the optimum melt temperature is determined from the graphs plotting  $\eta$  versus  $T$  and  $\dot{\gamma}$ ; this temperature ought to be maintained taking into account the thermomechanical effects impinging upon polyethylene in the course of extrusion [7]. With microprocessor control it is important to know for a mathematical description of the extrusion process the influence of the various factors (the geometry of the working elements; the clearance between the cartridge and the worm flight; the design of the head, which determines the counterpressure in case when all the other

variables are constant, etc.) as they affect the main processing parameters, including such relations as  $\eta = f(T)$ ;  $\eta = f(\gamma)$ ;  $T_{\text{melt}} = f(\text{MFI})$ ;  $T_{\text{melt}} = f(n)$ .

With certain assumptions, the Frankel-Eyring formula [8] can be used to estimate viscosity as a function of temperature:

$$\eta = Ae^{E/RT}, \quad (1)$$

where  $E$  is the energy of activation of viscous flow, kJ/mol K;  $R$  is the universal gas constant;  $T$  is absolute temperature, K; and  $A$  is a constant.

In practice, the power equation of Ostwald de Ville is commonly used, which expresses viscosity as a function of mean speed gradient,

$$\eta_{\text{eff}} = m\gamma^{n-1}, \quad (2)$$

where  $m$  is the rheological constant;  $n$  is the degree of non-Newtonian behavior of the polymer; and  $\gamma$  is speed gradient,  $s^{-1}$ .

The choice of the processing parameters depends also on the low-density polyethylene melt flow indicator. A relation of the polyethylene melt temperature favorable for film shaping as a function of melt flow indicator in the range of 0.1-20 g/10 min is given below. The melt temperatures are determined from the curves of the relations [9, 10]  $\eta = f(\gamma)$  and  $\tau = f(\gamma)$  when observing identical or similar values of rheologic characteristics and in the range of mean speed gradient  $10^2 - 2 \times 10^{-2} s^{-1}$

$$\text{MFI} = 100e^{-kT}. \quad (3)$$

The variation pattern of low-density polyethylene melt temperature as a function of MFI is similar for copolymer ethylene with vinyl acetate (figs. 2 and 3). Figure 2 shows the boundary regions of optimal temperatures of low-density polyethylene melt ( $M_w/M_n = 4-6$ ) as a function of MFI; figure 3 gives the same data for copolymer ethylene with vinyl acetate.

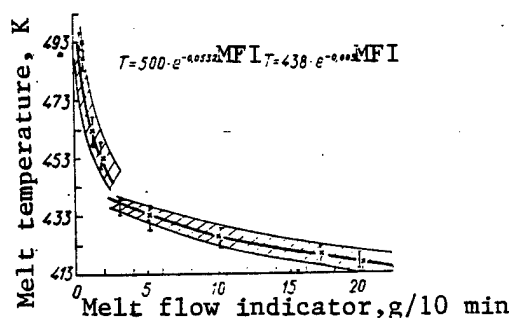


Figure 2

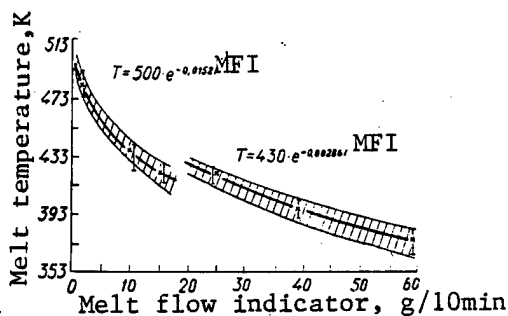


Figure 3

The melt flow indicator of low-density polyethylene 15802-020 remains unchanged when the rotation speed of the working organ of a worm press with

no mixing elements is raised from 40 to 110  $\text{min}^{-1}$ . A further increase of the worm rotation speed intensifies the mechanochemical processes and increases the melt flow indicator (fig. 4). Figure 4 shows the variation of melt flow indicator as a function of worm rotation speed when processing 15802-020 polyethylene on ChP 90 x 30 worm press in film manufacturing.

As the rotation speed of the working element is increased, the shear stresses and the difference of flow rates of polymer layers and the internal friction for a constant feed and stabilized press operation conditions lead to an increase of the melt temperature [11]. In the worm rotation speed range from 20 to 140  $\text{min}^{-1}$ , the polyethylene melt temperature at the outlet of the press head (fig. 5) is described by the relation

$$T_{\text{melt}} = T_0 + kn, \quad (4)$$

where  $T_{\text{melt}}$  is the melt temperature in the head, K;  $T_0$  is the temperature of the polymer prior to mechanical impact;  $n$  is the worm rotation speed,  $\text{min}^{-1}$ ;  $k$  is a coefficient.

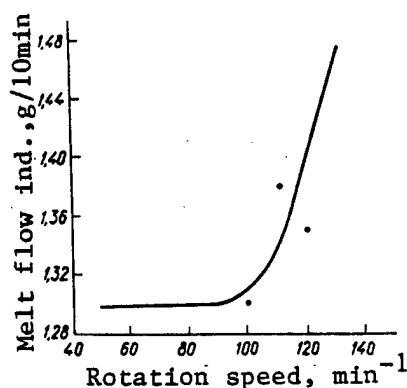


Figure 4

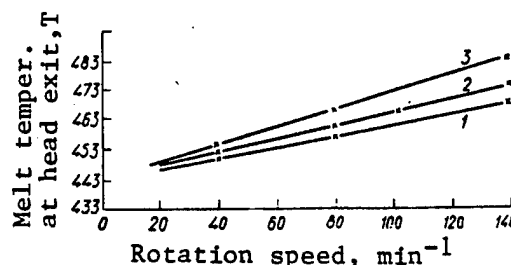


Figure 5

Figure 5 plots melt temperature at the outlet of the head of press ChP 63 x 30 vs worm rotation speed when processing high-density polyethylene grade 273-75. The relation between melt temperature and worm rotation speed for other thermosoftening plastic materials would be different. For example, for polystyrene it is expressed as follows:

$$T_{\text{melt}} = k_1 e^{k_2 n}, \quad (5)$$

where  $k_1$  and  $k_2$  are coefficients.

The functional relations that have been derived to describe the industrial process parameters for film production from polyethylene are of a considerable amount of assistance in development of mathematical model of the process, which is necessary for the creation of a microprocessor-based extrusion line control system.



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CSO: 1841/24

#### ORDER OF RED BANNER OF LABOR FOR MOSCOW TIRE PLANT

Moscow KAUCHUK I REZINA in Russian No 8, Aug 86 pp 2-4

[Article by A. V. Khomutinnikov and Yu. V. Smirnov]

[Abstract] By an Ukase of the Presidium of the Supreme Soviet of the USSR dated June 3, 1986, the Moscow Tire Plant was awarded the Order of the Red Banner of Labor for its achievements in the 11th Five-Year Plan. The Moscow Tire Plant stands as a beacon of progress for emulation by all factories and plants, and has always been noted for innovation, perseverance in the face of technical difficulties, and a collective socialist work ethic. In the 11th Five-Year Plan, the Moscow Tire Plant exceeded its tire production quota by 1.3%, and labor productivity by 8.7%. The plant is now in the process of undergoing extensive retooling and automation in order to further improve on its record of accomplishments in the future. Among the major goals for 1990 is the extension of tire life by 15% in comparison with the 1985 figures. The collective of the Moscow Tire Plant feels that a key stimulus to meeting CPSU plans for the future lies in the concept of the Socialist Competition.

12172/12955

CSO: 1841/69

#### CONTRIBUTIONS OF CHEMICAL SCIENCE TO AGRICULTURE

Minsk NARODNOYE KHOZYAYSTVO BELORUSSII in Russian No 10, Oct 86 pp 6-8

[Article by V. Komarov, academecian-secretary of Departments of Chemical and Geological Sciences of Belorussian SSR Academy of Sciences]

[Abstract] This is a lecture-type, popularized description of the exploitation of chemistry in agriculture. Chemization and products of the chemical industry play a major role in the development of the agricultural industry. Continued progress in agriculture and animal husbandry is not possible without active participation of scientists for new ideas and developments, effective systems, and analysis of material compositions. Growth of agroindustry, preservation of crops, creating new materials, increasing efficiencies of machines and materials are not possible without chemistry. Use of polymeric

films, pipes of polyethylene and polyvinyl, and plastics in place of metals in farm machines and apparatus not only improves processing and productivity but also reduces waste and conserves fertilizer and metals. In various branches of agriculture and machine construction, 35 forms of plastics are used now. In animal husbandry, animal feed additives of all kinds (amino acids, vitamins, enzymes, various elements, and others) are utilized. Chemical industry already now produces more than 200 substances for agriculture. One of the most important factors for increasing the efficiency of the agriculture industry is the chemization of the soil with wide use of mineral fertilizers, pesticides, and herbicides and the proper balancing of their usage. Our production of mineral fertilizers and pesticides is the largest in the world. In the last 10 years it has doubled. This year production must reach 26.5 million tons and 30-32 in 1990 (on 100% active basis). Projected output of N, P, K is 15.4 million ton or an 11.1 million ton shortage. Fertilizers are being used very ineffectively. High losses to ground and irrigation waters and poor usage of P is leading to high losses of fertilizers. A major immediate task for scientists, agricultural specialists, and chemical industry is to increase efficiency through new formulations, uniform grain size, and new and better methods of application. Production of fertilizers, to which trace amounts of B, Mn, Zn, Mo, Cu, Co and other elements are added, is planned and loss of such fertilizers to effluent waters has to be resolved. Effective use of mineral fertilizers by 30-40% depends on liming the acidic soils. Pesticides are important for crops but must be highly active in small doses and possess low toxicity to man and animals. The work of Belorussian scientists is cited from studies in the institutes of the Departments of Chemical and Geological Sciences. Though recent emphasis has been on the need to increase the supplies of mineral fertilizers and other chemical materials, now the emphasis is placed on their reasonable use and methods of application, a task for scientists, farmers, and chemical industry. A method for producing slowly-dissolving K fertilizers from by-products and fortifying them with necessary various elements has been developed. Technology for using peat to obtain a granular organo-mineral fertilizer which equals or surpasses the activity of standard fertilizers was created. Plans are to increase the efficiency of sandy and loamy soils, to determine the cheapest and most effective use of peat and sapropel as fertilizers, and to utilize by-products of the chemical industry. Effective and economic food additives for animals and poultry and creation of new chemical materials that are safe for man, animals and the environment are being studied. The theory and method for synthesizing hormone active materials for regulating breeding of animals were developed.

12886/12955

CSO: 1841/45

## CHEMICAL PRODUCTION AND ENVIRONMENTAL PRODUCTION IN ARMENIA

Yerevan KOMMUNIST in Russian 26 Oct 86 p 2

[Article unsigned]

[Abstract] This article reports a conversation with Chairman of Council of Ministers, Armenian SSR, F. T. Sarkisyan. Significant progress is reported for economic and agricultural developments in the Armenian SSR in recent years. Ten new large industrial installations were made; new railroad lines, automobile roads, irrigation canals and reservoirs were built. The need to protect the surrounding environment was considered. Basic decisions for protecting the environment and fundamental improvements in the conditions of water reservoirs, the land and atmosphere were stipulated by decreasing the discharge of harmful substances. This was done by technical reconstruction and closing some production units. In Yerevan, at "Nairit", dangerously explosive production with large volumes of discharges--calcium carbide, monovinylacetylene and chlorobenzene--were shut down and technical reconstruction and transformation of the production are being completed. Discharge of fluorine and other harmful compounds into the atmosphere at the Kanaker electrolytic aluminum plant were eliminated. Because of the large quantity of various large-volume chemical production at the Kirovakan chemical plant, it is one of the basic sources of pollution. Plans were formulated for reconstruction and technical improvement of the Kirovakan chemical plant and this will improve the ecology of the city. In 1986, production of calcium cyanamide, dicyandiamide and melamine was already being discontinued. In 1987, nitric acid and ammonium nitrate plants will close and ammonia production may be reduced. Automotive transport is the major source of atmospheric pollution in Yerevan and is responsible for more than 60% of all discharges into the atmosphere. Plans are underway to improve air quality and reduce toxicity and haze by introducing new motor fuels, regulating specifications for engines and air quality, and improving personnel and production of automobiles. Reductions of discharges into the atmosphere at the Alaverdi hearth-chemical combine were made from 104,000 tons in 1980 to 36,200 tons currently. Careful analysis of the processes at the Razdan hearth-chemical complex and its discharges projected the need for redesigning the plant. This was accomplished and it now functions as the Razdan-Machine Builder which in 1986 produced four times more than the old complex. In the last ten years for the entire republic, the volume of industrial production was increased twofold and the discharges of harmful substances were reduced. In developing some industries, mistakes were made. Practice has shown that some systems were adopted without considering all important factors. At "Nairit", the major source of gaseous effluents is in the production of acetic acid and of chloroprene rubber. Currently, production of chloroprene from acetylene is shut down and this has reduced the discharges of harmful substances into the atmosphere more than 1800 tons per year. Production of other materials was also curtailed. New manufacture of chloroprene rubber has equipment for reducing gaseous effluents. Equipment for thermal degasification of discharges in the acetic acid manufacture was added. Improvements at "Nairit" will reduce gaseous effluents from 23,000 tons per year to 3,100 tons per year. Gaseous effluents in the atmosphere were reduced by 27% in

1985 for the republic compared to 1980. Measures for purifying drainage waters are in progress and this work will continue. Any technology requires strict maintenance and operation, but the irresponsibility of some managers of some installations, particularly at "Nairit" in Yerevan in the chemical reactors for polyvinyl acetate, which still releases harmful effluents, prompted action for strict accountability. Large scale measures for construction of the auto road surrounding Yerevan and other streets for open movement of transport are planned for the capital. Increased auto production and use of gasolines of various quality will require cooperation and control to insure that autos and other carriers do not emit pollution to the atmosphere. Power plants pollute the air. The hydro station Sevan-Razdan from resources of the Sevan Lake works only in irrigation systems and the basic load for a power source falls on the Armenian nuclear and fuel electro-stations of Yeveran, Razdan and Kirovakan using natural gas and mazut fuel.

12886/12955  
CSO: 1841/48

#### RETOOLING AND RECONSTRUCTION AS COLLECTIVE RESPONSIBILITY: EXPERIENCE OF UFA INDUSTRIAL RUBBER PRODUCTS PLANT

Moscow KAUCHUK I REZINA in Russian No 8, Aug 86 pp 43-44

[Article by M. B. Shulkin]

[Abstract] The success of the Ufa Industrial Rubber Products Plant in exceeding planned production and productivity quotas in the 11th Five-Year Plan had come about as a collective effort. The entire collective was dedicated and participated in a myriad of measures involving retooling and restructuring of the manufacturing facilities, with the net effect that productivity increased by 20.3%, which was equivalent to cutting the work force by 1142 workers. In monetary terms, the cost effectiveness of such measures exceeded 6.1 million rubles. Innovative technology reduced the number of manual operations by 9.7%, released 500 workers from strictly manual work, and eased the work assignments and improved the working conditions of an additional 2500 workers. Equally impressive are the figures dealing with new discoveries and inventions made at the plant: the implementation of 53 such inventions had an economic impact to the tune of 1 million 253 thousand rubles. For the 12th Five-Year Plan, ambitious plans have been made for greater introduction of computer-based technology and advanced automatic control systems, development and introduction of radiation vulcanization, and further retooling and introduction of new machinery at the work place.

12172/12955  
CSO: 1841/69

## IMPROVEMENTS IN NORMATIVE PLANNING METHOD OF REAL WAGES AT TIRE PLANTS

Moscow KAUCHUK I REZINA in Russian No 8, Aug 86 pp 44-47

[Article by V. Ya. Chevychelov and V. A. Shain]

[Abstract] A common problem encountered in the economics of the tire industry in the 11th Five-Year Plan was the fact that the increases in real wages at many plants exceeded increases in productivity. To a large extent this had been predicated on the manner in which work is organized and the difficulties attendant to the calculations employed in estimating real costs, overtime, indirect work, etc. The basic conclusions that have been reached indicate that, in the tire manufacturing industry, the relationship between real wages and the value of the final product is insignificant. To correct the situation, recommendations have been made that the normative planning method for real wages, approved by the CC CPSU and the Council of Ministers on July 12, 1979, be employed on a wide scale in the tire industry. Tables 1; references 1 (Russian).

12172/12955

CSO: 1841/69

## INDUSTRIAL CONTRIBUTIONS BY INNOVATORS

Moscow KAUCHUK I REZINA in Russian No 8, Aug 86 pp 47-48

[Unattributed article]

[Abstract] In 1986, meetings of rationalizers and inventors were held at the "Krasnyy Treugolnik" Production Association and the Synthetic Rubber Plant imeni S. M. Kirov to summarize the results of their work in recent years. The implementation of rationalization proposals and inventions have repeatedly been demonstrated to be cost effective, in millions of rubles. One of the primary concerns of new innovations is to reduce the amount of manual work in the industry and facilitate automation. Encouragement and training are provided to newcomers to the field, along with instillation of the appropriate socialist work ethic and emphasis of the benefits to be derived by the Soviet economy from more productive manufacturing technology.

12172/12955

CSO: 1841/69 -

## MAN AS FOCAL POINT IN CHEMICAL INDUSTRY PRODUCTION

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 8, Aug 86 pp 450-452

[Article by I. M. Muradov, deputy minister of the Chemical Industry]

[Abstract] The chemical industry is in a period of rapid change. Errors, inertia and fear of change on the part of some administrators have been very costly. Some managers have been administratively punished for breaking ethical standards which apply to enterprise managers. Only people with a new approach to the solution of production and social problems can work in the new way, life has shown. Unfortunately, radical changes have not occurred yet in the style and methods of operation of functional administrations. Use of degree-holding specialists in jobs as simple workers cannot be tolerated. The labor of the chemical worker must be given new prestige, considering the small number of new young workers who will enter the industry during the present Five-Year Plan. Such features as vacations at resorts owned by the industry, availability of good housing for workers, provision of child care and maintenance of company-owned farms for the benefit of employees are important in this respect. However, a number of large chemical plants have not seen the light and still do not have such farms. What is needed is daily attention to activation of the human factor to improve the productivity of the industry.

6508/12955

CSO: 1841/33

## SCALE TRANSITION FROM LABORATORY AND EXPERIMENTAL STUDIES TO PRODUCTION

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 8, Aug 86 pp 497-501

[Article by V. P. Pavlov and Ye. I. Martyushin]

[Abstract] New processes are traditionally developed on a very small scale in the laboratory, then carried through pilot and intermediate scale operation to full production scale. A second approach is one of detailed study of the physical essence of the complex phenomena involved in the interaction of reagents, phases and flows and development--on the basis of the study--of measures to eliminate factors causing reduced effectiveness as the scale of a process is enlarged. This active approach requires that studies in the traditional stages of development of processes be altered somewhat. The laboratory study is then used to determine the possibility in principle of performing a process, study the mechanism of the basic reactions involved, determine the end and intermediate or side products and study the physical and chemical properties of the new substances. Pilot-scale operation is intended to develop batches of the product from actual raw material, not laboratory raw materials and to generate data which can be used to construct mathematical models of the major processes and required hardware, allowing determination of the optimal characteristics of the entire technological system. Thus, in the active approach, the problem of the scale transition

from laboratory studies to industrial apparatus is solved using mathematical models created on the basis of results of laboratory and pilot studies. These problems are analyzed using development of a large scale reactor with a fluidized bed and mass transfer apparatus with plates of various designs as an example. References 58: 42 Russian, 16 Western. References 58: 42 Russian, 16 Western.

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CSO: 1841/33

UDC 678.057.9

#### EQUIPMENT FOR PRODUCTION OF MONOLITHIC POLYURETHANE PRODUCTS

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian, No 11, Nov 86.  
pp 14-15

[Article by Candidate of Technical Sciences E. Ya. Apanasenko]

[Abstract] Liquid forming of polyurethane products can be automated with microprocessor equipment. A system of equipment has been developed including equipment for heating of the raw material, a low-pressure casting installation with a capacity of 0.2 to 10 kg/min for one- and two- stage manufacture of polyurethane products, and equipment for vulcanization and curing of the products. This article briefly describes the equipment, noting the importance of degassing and drying, measuring and mixing stages in the casting process. The equipment uses precision gear pumps to achieve precise volumetric dosing, dynamic mixers for good and continuous mixing of the components, plus a static initial mixer. Figure 1; references 3 (Russian).

6508/12955  
CSO: 1841/41

UDC 681.3:531.781.2

#### SYSTEM FOR AUTOMATED PROCESSING OF RESULTS OF TENSOMETRY USING SM SERIES COMPUTERS

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 11, Nov 86  
pp 20-21

[Article by Engineer B. S. Volfson]

[Abstract] The All-Union Scientific Research Institute of Petroleum Machinery has developed a system for automated processing of the results of tensometry based on SM series minicomputers, distinguished by relatively low cost and ease of connection of peripheral devices. Magnetic disk or tape storage units are used for intermediate storage of results. The application software used for the process is called TENEXP, and consists of five dialog-mode



programs: TEXINP, TEXEDT, TESTAT, TEDSIS and TEHELP. The operation of each program is briefly described: TEXINP is used for input and storage of initial data on magnetic disk or tape, TEXEDT edits the data stored on disk or tape, TESTAT performs primary statistical processing of the results of measurement, TEDSIS computes the results of primary statistical processing and calculates precise estimates of the major deformations and stresses under instructions from the operator, and TEHELP is intended to eliminate the influence of zero drift caused by external factors on repeat testing. The programs are written in FORTRAN-IV. Future plans include direct transmission of information from test instruments to the computer, bypassing the intermediate punch tape presently used. References 2 (Russian).

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UDC 658.012

#### MANAGEMENT SYSTEM ASSURING EASE OF MANUFACTURE OF PRODUCT STRUCTURES

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 11,  
Nov 86 pp 41-44

[Article by Candidates of Technical Sciences V. L. Mikhelson-Tkach, V. M. Panchenko, Candidate of Economic Sciences A. A. Izotenzov and Candidate of Technical Sciences T. P. Tereshkova]

[Abstract] Existing State standards form the basis for creation of a system of management to assure ease of manufacture of new products. However, these documents formulate only the basic concepts in the area of ease of manufacture and provide a system of generalized indicators for machine building and instrument building, plus standard methods for estimating ease of manufacture. This article analyses the problems involved in development of a comprehensive ease-of-manufacture management system. A system of technical standards documents has now been developed for the creation of a branch ease-of-manufacture management system. Management includes planning of steps to assure ease of manufacture, accounting for levels of ease of manufacture achieved by means of a system of indicators, monitoring of ease of manufacture by qualitative and quantitative estimation and testing, regulation of performance of steps to assure ease of manufacture and prevent introduction of designs which are not easy to manufacture. This system of documentation is said to have implemented a well ordered system for management of ease of manufacture in industry.

6508/12955  
CSO: 1841/41

## PAYMENT OF WAGES TO FOREMEN AND ENGINEERING-TECHNICAL PERSONNEL OF PRODUCTION TEAMS

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 11,  
Nov 86 pp 44-46

[Article by Engineers Yu. V. Rozhkin and V. N. Valeyev]

[Abstract] To reduce conflict situations, many organizations are combining the duties of foreman and team leader, which also improves organization and wages in the team, increasing the material interest of the foreman-team leader in improvement of the results of the work of the team. The foreman under these conditions is concerned not only with organization of production and labor, but also with performance of the most difficult and important operations involved in manufacture of products, all of which increases the authority of the foreman in the eyes of other team members. In order to eliminate the multiplicity of methods used to calculate the wages of foremen-team leaders, the State Committee Labor and the All Union Council of Trade Unions have jointly approved a document on computation of wages and material stimulus for foremen and other engineering and technical workers in consolidated production teams in industry and construction. This article briefly describes the calculation methods implemented by this new document.

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CSO: 1841/41

## ADVANCES IN FERMENTATION EQUIPMENT FOR MEDICAL INDUSTRY

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 10,  
Oct 86 pp 6-8

[Article by V. A. Osenkina, candidate of technical sciences, as follow-up to article by Ye. S. Bylinkina, "Fermenter Requirements for Antibiotic Biosynthesis", No 5, 1984]

[Abstract] In addition to the fermenters with mechanical mixing, covered by Bylinkina, the Irkutsk Scientific Research Institute of Machine Design and Construction is also involved in research and design of large-volume (50-63 m<sup>3</sup>) fermenters with nonmechanical mixing. The latter, involving various air-lift and pneumatic devices have been found to be cost-effective and highly productive systems suitable for use in the medical industry. Contrary to the impression of many that such fermenters cannot be used with pure mycelial cultures because of their high viscosity, trials have demonstrated their utility to be on par with mechanical fermenters in the production of penicillin. Further improvements are continually being introduced to improve their ease of service, sampling, monitoring, and reliability. References 9: 8 Russian, 1 Western.

12172/12955  
CSO: 1841/66

## COMBINED PROGRAM FOR DEVELOPMENT OF CHEMICAL AND PETROLEUM MACHINE BUILDING

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 11,  
Nov 86 pp 48

[Unsigned article]

[Abstract] On 12 Aug 1986, the collegium of the Ministry of Chemical Machine Building, with the participation of leaders of scientific-production and production associations, enterprises and organizations, analyzed the question of approving a combined program for scientific and technical progress, economic and social development of the chemical and petroleum machine building branch of industry during the twelfth five year plan. The program outlined discusses specific assignments in terms of growth rates of the productivity of labor, decreases in cost of products produced and a number of other technical and economic indicators. A significant increase in capital investment is included, intended to develop the branch and, particularly, to replace obsolete equipment and machine tools, expanding the use of program-controlled machine tools. The production of precision parts by such methods as powder metallurgy is to be increased, savings of all types of materials and particularly of metal and fuels are to be expanded. A resolution was passed approving the combined program for scientific and technical progress, economic and social development.

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CSO: 1841/41

UDC 338.93

## FUNDAMENTAL ASPECTS OF SUMY AND OTHER LARGE-SCALE SELF-SUPPORTING ECONOMIC EXPERIMENTS

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 10,  
Oct 86, pp 31-33

[Article by A. Ya. Daugello, deputy chairman, Main Economic Planning Administration, Ministry of Machine Design and Construction]

[Abstract] In January 1985 all of the enterprises of the Ministry of Machine Design and Construction entered upon an economic experiment to assess the feasibility and effectiveness of operation on a self-supporting basis. The most profound and extensive experimentation in self-financing, however, has been carried out at the Sumy Machine Design and Construction Scientific Production Association (SMDCSIA) imeni M. V. Frunze. Since the institution of this program, SMDCSIA has operated entirely on a profit basis with its economics determined by local decisions based on market conditions. In comparison with the other establishments, the profitability and productivity of SMDCSIA has by far exceeded the economic performance of the establishments on a more limited course of independent decisionmaking. Although preliminary, these observations provide further impetus for expanding and refining

large-scale experiments in financial self-sufficiency in the industrial sector. [Note: a second article on this subject appeared in Source journal, No 11, 1986]

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CSO: 1841/66

UDC 338.93

LARGE-SCALE AND SUMY EXPERIMENTS. PROFIT AND INDEPENDENT FINANCING (ARTICLE TWO)

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 11, Nov 86 pp 40-41

[Article by A. Ya. Daugello, deputy chief, Main Planning and Economics Administration, Ministry of Chemical Machine Building]

[Abstract] Profit is a major indicator included in the annual plans for economic and social development of chemical and petroleum machine building facilities, which have been operating under the conditions of a large scale economic experiment since 1985. Profit is the major source of funding for capital investment, the development of science and technology, increases in operating capital, repayment of bank loans and creation of funding for economic stimulus. However, preference is given to the cost of goods produced in detailed planning of the activity of enterprises, which does not guarantee that profit goals will be met. The author concludes that preference should be given to the profit figure rather than the cost figure in all planning. This has been done in the Sumy experiment [at an NPD--Scientific Production Association]. The range of application of economic standards has been expanded in this experiment as well. Operation of the experiment as it applies to the Scientific-Production Association imeni M. V. Frunze is described. Results of this experiment indicate the need for further expansion of the scale and improvement of methods of independent financing of production facilities. [Note: the first article on this subject appeared in Source journal, No 10, 1986].

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CSO: 1841/41

NEW ADVANCES IN CHEMICAL AND OIL MACHINERY CONSTRUCTION AND DESIGN

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 10, Oct 86 pp 1-2

[Abstract] On July 16, 1986 an extended meeting was organized in Penza by the USSR Ministry of Chemical and Oil Machinery Design and Construction, which involved the collegium and the party organization of the Ministry in a discussion of the trends and advances in this branch of the Soviet economy

in light of the 1986 June Plenum of the CC CPSU, and the 11th convocation of the 5th session of the Supreme Soviet. Progress and shortcomings were summarized in the talk given by Minister V. M. Lukyanenko, who also noted that in the 12th Five-Year Plan some 60% of the increase in production should come about as a result of retooling, automation, greater productivity of existing facilities, and the introduction of two- and three- shift work schedules. The meeting emphasized the importance of the work of the collegium and the party organization in the implementation of the decisions of the Plenum and of the Supreme Soviet in the chemical and oil machinery industry. Furthermore, the collegium and the party organization expressed their full confidence in the workers of the industry and in their ability to meet the challenges of the 12th Five-Year Plan.

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CSO: 1841/66

UDC 677.4

#### TRENDS IN CHEMICAL FIBER PRODUCTION IN USSR

Moscow KHIMICHESKIYE VOLOKNA in Russian No 5, Sep-Oct 86 pp 3-6

[Article by V. S. Smirnov, deputy minister, Chemical Industry]

[Abstract] In the last Five-Year Plan the production of chemical fibers in the USSR has shown a significant improvement, reaching a figure of 16.3 million tons in 1984. In that time frame, the volume due to synthetic fibers has increased from 68 to 80%, and in the future this percentage is expected to increase even further. Soviet production of chemical fibers is subject to global economic conditions on a larger scale. However, the internal market is sufficiently strong to obviate many adverse economic conditions that may plague the capitalistic economies. Current research efforts are directed at producing fibers that meet the requirements of the space age, and involve improvements in current products and the creation of novel fibers. Extensive efforts are underway at modernization of viscose fiber producing facilities, improvements in the fibers themselves, and monitoring of the environmental impact of such plants. Considerable efforts are also being expanded on enlarging the capacity for polyamide fibers and for improving their performance characteristics, the creation of composite fibers (polyamide-polyester, polyester-viscose, etc.), and the production of ultrafine fibers. A marked increase in the production of polyacrylonitrile fibers is anticipated as a result of extensive restructuring of the industry. In addition, the era of third-generation synthetic fibers is now at hand which is expected to have a serious impact on technology and the domestic market.

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CSO: 1841/62

## EXPERIENCE OF USE OF THE "KARPOV" WAGE SYSTEM AT "PLASTMASSY" SCIENTIFIC-PRODUCTION ASSOCIATION, SCIENTIFIC RESEARCH INSTITUTE OF PLASTICS

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 86 pp 56-57

[Article by Ye. N. Domrachev and G. P. Lyubimtseva]

[Abstract] Since the late 1960's, an experimental system of payment of wages to scientific workers has been in use at the Scientific Research Physical-Chemical Institute imeni L. Ya. Karpov. Under this system, the wages paid to scientific workers depend directly not only on academic degrees and position, but also on effectiveness of scientific activity. An additional 67 institutes have since started using this highly successful system, including the "Plastmassy" Scientific-Production Association of the Scientific Research Institute of Plastics imeni G. S. Petrov. Since the new system was introduced, the economic indicators of the institute have greatly improved. During the 11th Five-Year Plan, the volume of scientific research work increased by 18%, with a simultaneous decrease in number of employees by 5.8%. The mean monthly wages paid during this period increased by 6%. The major criterion used to evaluate the activity of workers at the institute is the status and introduction of developments, time required to complete studies and their scientific-technical level, and creative activity. A central certification committee has been set up whose members include the scientific deputy director, chiefs of scientific functional divisions, chief economists, party and social organization representatives, to analyze the effectiveness and importance of work performed by employees. The "Karpov" system has been shown to be more progressive than the system previously used.

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CSO: 1841/37

## BASIC SCIENTIFIC AND TECHNOLOGICAL RESEARCH TRENDS AND THEIR IMPLEMENTATION IN RUBBER FOOTWEAR INDUSTRY

Moscow KAUCHUK I REZINA in Russian No 10, Oct 86 pp 2-6

[Article by V. A. Berestnev and Yu. N. Neyenkirkhen]

[Abstract] The 27th Party Congress placed major emphasis on the implementation of the latest advances in science and technology in the Soviet industry, in order to assure continuing development of the economy of the USSR. The personnel of the Scientific Research Institute of Rubber and Latex Products, taking these exhortations to heart, have made a maximum effort in assuming greater responsibility for the quality of their research, increasing their productivity, and in further improving the cost-effectiveness figures for

the Institute. In the period 1981-1985 several hundred new products appeared on the market as a result of the research conducted at the Institute, in conjunction with a two-fold increase in their cost-effectiveness in comparison with the financial figures for the 10th Five Year Plan. A similar improvement in productivity is being anticipated for the 12th Five-Year Plan and to the year 2000. This anticipation is based on the introduction of new technology and new scientific advances into the production of various rubber and latex products, including footwear. Not the least significant factor is the implementation of new and improved automatic control systems relying on more advanced software. References 2 (Russian).

12172/12955  
CSO: 1841/35

#### RECONSTRUCTION AND TECHNOLOGICAL RETOOLING

Moscow KAUCHUK I REZINA in Russian No 10, Oct 86 pp 6-7

[Article by L. V. Pasternak]

[Abstract] The 27th Party Congress called for extensive restructuring of the Soviet industry to meet the challenges of the 12th Five-Year Plan and beyond. The tire industry is faced with particularly hard choices because of outdated equipment and machinery, but the various manufacturing plants have shown resolve in meeting the challenges. Thus, in 1986 the Kirov Tire Plant commenced the production of radial tires, a move that required extensive reorganization of operations and restructuring of existing physical facilities. Automation is of primary importance, and is best illustrated at such plants as the Voronezh plant. There, manual labor accounts for 45% of all the operations, a problem further complicated by the slow implementation of automation. Obviously, intensification of effort directed at expanding automation must be a primary goal at many tire plants if they are to meet the goals of the 27th Party Congress. References 1 (Russian).

12172/12955  
CSO: 1841/35

#### 12th PLENUM OF CENTRAL COMMITTEE OF CHEMICAL AND PETROCHEMICAL WORKERS' TRADE UNION

Moscow KAUCHUK I REZINA in Russian No 10, Oct 86 pp 47-48

[Article by Yu. I. Vlasov]

[Abstract] The 12th Plenum was held on July 14, 1986 and dealt largely with improvements in work conditions, discipline at the worksite, and instillation of the work ethic. Particular notice was taken of the Tatar ASSR, where half of the chemical and petrochemical plants failed to meet quality control standards: over 48% of their products fell below global

standards. To correct this situation in the future, and to accelerate the slow pace of plant modernization, it has been recommended that a "Quality" program be developed for 1986-1990. This will require extensive re-education of the workers and management and rededication to high quality work and responsibility.

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CSO: 1841/35

UDC 661.715.336

#### SYNTHESIS AND USES OF 1-HEXANE

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 10, Oct 86 pp 595-596

[Article by T. G. Minko and A. V. Timofeyev]

[Abstract] An analysis of the factors involved in the conversion of 1-hexanol into 1-hexene over  $Al_2O_3$  led to definition of the optimal reaction conditions. A conversion rate of 90-95% was attainable under a temperature of 300-320°C with a catalyst pretreated with 0.25% KOH. 1-Hexene has found extensive use in homo- and copolymerization. Incorporation of 1-hexene into low-density polyethylene imparts to it the mechanical characteristics of high-density polyethylene, extending the scope of application of the former. Figures 3; references 14: 9 Russian, 5 Western.

12172/12955  
CSO: 1841/34

UDC 66.013.[658.53:658.512.626]

#### COMPUTER SIMULATION OF ORGANIZATION AND STANDARDIZATION OF WORK INVOLVED IN MULTI-MACHINE OPERATION AT CHEMICAL PLANTS

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 10, Oct 86 pp 634-637

[Article by G. S. Gavrilov and V. A. Shpigel]

[Abstract] In order to improve on the relatively low level of productivity in the chemical industry, computer simulation was employed to organize and standardize work of multi-machine operators at plastics processing plants. The operations were defined into individual steps and sequences for the creation of mathematical models, employing the Monte Carlo method for statistical evaluation. The resultant computer models led to more rational displacement of machinery and more efficient operational sequences, which resulted in a significant increase in productivity at the Borisov Plastics Plant in 1984.

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CSO: 1841/34



USE OF COMPUTERS FOR INCREASING FLEXIBILITY OF TECHNOLOGICAL SYSTEMS OF  
PRODUCTION OF LOW VOLUME CHEMICAL PRODUCTS

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 10, Oct 86 pp 637-638

[Article by A. M. Mirokhin and V. A. Falin]

[Abstract] The use of computers has become a key factor in the ability of plants engaged in the production of specialty or limited-demand chemical products to meet variable market conditions. In addition to basic retooling and modification of the technological systems, a detailed analysis of the various steps is required to ensure efficient operation in a new mode. Using filtration systems as an example, data processing of the performance of a given filter or system at other plants may yield valuable information on reliability applicable to the situation at hand. Such an approach may reduce to a minimum the need for expensive experimental studies, and the utilization of extant information makes possible a more rapid switchover. References 6 (Russian).

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GALVANIC APPLICATION OF MAGNETIC MEDIA TO DISKS

Moscow ELEKTROKHIMIYA in Russian Vol 22, No 8, Aug 86  
(manuscript received 14 Nov 84) pp 1011-1019

[Article by S. Armyanov, Institute of Physical Chemistry, Bulgarian Academy of Sciences, Sofia, Bulgaria]

[Abstract] The problem of manufacture of thin-film, hard-disk media can be analyzed in various aspects. This review covers electrochemical problems, the solution of which will allow the manufacture of modern magnetic media for both conventional and perpendicular or vertical recording methods. The term "galvanic" is used in the sense of combined electrochemical and chemical methods of application of layers, and is synonymous with "plated." Problems related to increasing recording density in thin-film plated media intended for both conventional and vertical recording techniques are discussed. Developments expected in the near future include further advances in technologies for plated manufacture of disks, particularly for conventional recording. Efforts will be directed toward improvement of parameters, increasing the yield of useable products and decreasing costs. New hybrid technologies may also appear, combining chemical precipitation with cathode atomization. All of this will place increased requirements on a deeper understanding of the mechanism and kinetics of the processes used. Figures 2; references 128: 44 Russian, 84 Western.

6508/12955  
CSO: 1841/43

## INFLUENCE OF ANODE POLARIZATION MODE UNDER STEADY ILLUMINATION CONDITIONS ON FORMATION AND PROPERTIES OF POROUS SURFACE LAYER ON n-SILICON

Moscow ELEKTROKHIMIYA in Russian Vol 22, No 8, Aug 86  
(manuscript received 15 Oct 84) pp 1055-1061

[Article by S. O. Izidinov, A. P. Blokhina and T. S. Martynova, All-Union Electrotechnical Institute imeni V. I. Lenin, Moscow]

[Abstract] Results are discussed from studies of the process of formation of the porous surface layer and integral dissolution of n-type of silicon under steady illumination over a broad range of flux density in 48% HF, as well as the properties of the surface layer, particularly density, which indicates the relationship among the processes occurring at the anode. The discussion is based on data on photoelectrochemical behavior of n-type silicon, the mechanism and kinetics of anode processes of oxidation, specifics of the kinetics of the porous layer growth on n and p type silicon. It is found that more porous layers are formed on n-type silicon in the area of low values of flux density, not over  $5 \cdot 10^{-2}$  A/cm<sup>2</sup>, with density lower, the lower the flux density. The critical value of flux density, above which less porous layers are formed, corresponds to the value of limiting hold current on the n-type light polarization curve. A more porous structure is created under conditions such that the consumption of holes in the anode reaction does not disrupt the steady state fixed by the intensity of photo-generation of charge carriers. This forms a porous layer with a branched system of microscopic pores, density 1.25-1.7 g/cm<sup>3</sup>. The dominant reaction under these conditions is oxidation of silicon to the bivalent state. Figures 7; references 11: 5 Russian, 6 Western.

6508/12955  
CSO: 1841/43

## PHOTOELECTROCHEMICAL OXIDATION AND CHLORINATION OF CERTAIN AROMATIC HYDROCARBONS ON SEMICONDUCTING ANODES

Moscow ELEKTROKHIMIYA in Russian Vol 22, No 8, Aug 86  
(manuscript received 22 Oct 84) pp 1069-1072

[Article by E. M. Kuliyeu, A. S. Suleymanov and U. Kh. Agayev, Institute of Chloroorganic Synthesis, AzSSR Academy of Sciences, Sumgait; Institute of Inorganic and Physical Chemistry, AzSSR Academy of Sciences, Baku]

[Abstract] A study is reported of the photoelectrochemical oxidation and chlorination of benzene, toluene and p-xylene, in the presence of hydrochloric acid, on illuminated n-type semiconducting electrodes. The experimental approach is one of comparing the electrochemical and photoelectrochemical

characteristics of the processes excited by light with the wavelength of the natural absorption of titanium dioxide and zinc oxide. The comparison indicates that the semiconducting nature of the surface of the anode helps to stabilize radicals, effectively removing them from the reaction. This provides for selective oxidation and chlorination of the aromatic hydrocarbons. Figures 4; references 10: 7 Russian, 3 Western.

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UDC 546.31+541.13

#### MATERIALS FOR ELECTROCHEMICAL SYSTEMS BASED ON COMPOUNDS OF RARE ALKALINE ELEMENTS

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIYE NAUKI in Russian Vol 15, No 5, Sep-Oct 86  
(manuscript received 21 Jan 86) pp 47-61

[Article by N. P. Tomilov, A. S. Berger and V. V. Boldyrev, Institute of Solid State Chemistry and Processing of Mineral Raw Materials, Siberian Department, USSR Academy of Sciences, Novosibirsk]

[Abstract] The purpose of this review was to show the role of rare alkaline elements in the development of new materials for modern electrochemical systems such as fuel cells, electrolyzers, chemical sources of electric current and sensors for analysis of liquid and gaseous media. Primary attention has been concentrated on the current status of scientific research in this area, unsolved scientific and technical problems and developmental trends. A continuing problem is prediction of solid materials with good conductivity with respect to silver, copper, fluorine and hydrogen ions, selection of the chemical composition and type of crystalline structure required to produce good alkaline batteries. The possibility of using a specific solid electrolyte in a specific electrochemical device is determined both by conductivity and by its resistance to the effect of the active electrode materials and surrounding substances, making the development of materials for specific electrochemical allocations an important job. The development of new materials in this area must be based on achievements of solid state chemistry. References 120: 34 Russian, 86 Western.

6508/12955  
CSO: 1841/27

UDC 541.124.7:546.171.5:621.375.8

INFLUENCE OF INHIBITORS ON REACTION OF TETRAFLUOROHYDRAZINE WITH HYDROGEN

Moscow KHIMICHESKAYA FIZIKA in Russian Vol 5, No 8, Aug 86  
(manuscript received 30 May 85) pp.1111-1117

[Article by A. N. Skachkov and G. F. Sosnina]

[Abstract] Results are presented from studies of the limits of flammability of the mixture  $N_2F_4:H_2 = 1:2$ . Both traditional heating through a wall and homogeneous heating with the radiation of a CO laser were used. Experiments were performed in a static transmission installation used to determine the limits of flammability. With no inhibitors present, an upper limit of flammability with respect to pressure was found, above which no reaction occurred in the system. The upper limits of flammability were found to be 242 and 350 Torr at 295 and 303K. No lower limit of flammability was found. Introduction of hydrocarbons constricts the area of flammability of the mixture. The variation in change of limiting pressure with temperature with fixed concentrations of ethylene inhibitor of 1, 2.5 and 5% by volume was studied. The presence of a lower limit of flammability of the system  $N_2F_4-H_2$  indicates the chain mechanism of the chemical process. Above a curve on the pressure-temperature chart the reaction is explosive, below the curve it occurs extremely slowly. Increasing the concentration of the inhibitor causes ignition to occur at a higher temperature. Figures 3; references 17: 13 Russian, 4 Western.

6508/12955  
CSO: 1841/22

UDC 546.16

$\text{LnF}_3\text{-CoF}_2$  SYSTEMS

Moscow ZHURNAL NEORGANICHESKOY KHIMII in Russian Vol 31, No 9, Sep 86  
(manuscript received 5 Feb 86) pp 2385-2388

[Article by V. S. Sidorov and M. B. Ikrami, Institute of Chemistry, imeni  
V. I. Nikitin, Tajik SSR Academy of Sciences]

[Abstract] Materials have been produced based on rare-earth-element fluorides or containing rare-earth-element fluorides, widely used as lasers. This article studies condensed-state diagrams of the systems  $\text{LnF}_3\text{-CoF}_2$  ( $\text{Ln}=\text{Gd}, \text{Tb}, \text{Dy}, \text{Ho}, \text{Er}, \text{Tm}$ ) by differential thermal, x-ray phase and crystalloptical methods in order to obtain information on the formation of new compounds or solid solutions and investigate their physical and chemical properties, areas of stable existence and optimal synthesis conditions. State diagrams of the systems are constructed. The systems with cobalt difluoride are found to be simple eutectic systems with limiting solid solutions. Systems with cobalt fluoride have nonvariant metatectic equilibrium between the liquid phase and the high temperature modification of the rare-earth-element trifluorides. Figure 1; references 6: 5 Russian, 1 Western.

6508/12955  
CSO: 1841/55

UDC 545.85

FORMATION ENTHALPY OF GASEOUS  $\text{PbF}_2$ ,  $\text{Pb}_2\text{F}_4$  and  $\text{PbF}$

Moscow ZHURNAL NEORGANICHESKOY KHIMII in Russian Vol 31, No 9, Sep 86  
(manuscript received 3 Jan 85) pp 2195-2199

[Article by Yu. M. Korenev, A. N. Rykov, S. V. Kuznetsov, A. I. Boltalin  
and A. V. Novoselova, Moscow State University imeni M. V. Lomonosov]

[Abstract] The enthalpy of sublimation of  $\text{PbF}_2$  and  $\text{Pb}_2\text{F}_4$  and the enthalpy of the reaction  $\text{Pb}_2\text{F}_4 (\text{gas}) = 2\text{PbF}_2 (\text{gas})$  were calculated according to the third law of thermodynamics. Pressures used in the calculation were taken

from a previous work by the same authors, the thermodynamic functions from the JANAP Handbook. The results are presented in tabular form. References 11: 3 Russian, 8 Western.

6508/12955

CSO: 1841/55

UDC 541.451:548.73:535.15

#### SYNTHESIS AND PHYSICAL CHEMISTRY STUDY OF $\text{LiCrTeO}_4$

Moscow ZHURNAL NEORGANICHESKOY KHIMII in Russian Vol 31, No 9, Sep 86  
(manuscript received 14 Dec 84) pp 2220-2222

[Article by O. V. Sorokina, I. G. Chaban, V. V. Safonov and N. V. Porotnikov,  
Moscow Institute of Precision Chemical Technology imeni M. V. Lomonosov]

[Abstract] There is considerable interest in phases and systems containing tellurium dioxide as materials for optics and acousticoptics studies. The authors had studied the cross section  $\text{LiCrO}_2\text{-TeO}_2$  in the system  $\text{Li}_2\text{O-Cr}_2\text{O}_3\text{-TeO}_2$ , and established the formation of a new phase with the composition  $\text{LiCrTeO}_4$ . This article presents the results of a study of the properties of this compound by physical and chemical analysis methods (DTA, x-ray phase analysis and IR spectroscopy). Synthesis was performed by slow heating of lithium carbonate and chromium (III) and tellurium (IV) oxides in a stoichiometric ratio. Differential thermal and x-ray analyses indicate that interaction occurs in several stages, with lithium carbonate interacting with tellurium dioxide at 370°C, the material formed melting at 450-500°C and, after cooling, forming a greenish glass which crystalizes when heated at 430°C, accompanied by liberation of heat. When the temperature is raised to over 600°C, the chromium (III) oxide enters the reaction forming  $\text{LiCrTeO}_4$ , a green polycrystalline powder. At 930°C this compound undergoes reversible solid phase conversion. IR spectroscopy indicates that the high temperature form has the same spectral interval as the low temperature form; however, the total number of frequencies in the spectrum of the  $\beta$  form is significantly greater than in the spectrum of the  $\alpha$  form, indicating a greater number of formula units in the unit cell of the  $\beta$  phase. Figures 2; references 5: 3 Russian, 2 Western.

6508/12955

CSO: 1841/55

NITROGEN COMPOUNDS

UDC 543.257.1:546.268.2

POTENTIOMETRIC TITRATION OF ISOCYANATE GROUPS IN DIPHENYLMETHANE-4,4'-  
DIISOCYANATE

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan 86  
(manuscript received 4 May 85) pp 57-58

[Article by G. D. Mikhaylov, T. I. Samsonova, V. V. Bogoslavskiy and  
S. A. Ivanova]

[Abstract] A method has been devised for direct potentiometric titration of isocyanate (NCO) groups in diphenylmethane-4,4'-diisocyanate (DMI), which avoids falsely high results due to di- or polyisocyanate impurities. The titrating agent consists of a 0.5 N piperidine-in (anhydrous) dimethylformamide (DMF) solution, which is added to 0.2-0.4 g of DMI in 30 ml of DMF for potentiometry. Comparison of the potentiometric method with standard techniques using reverse titration demonstrated the greater reliability of the former approach in titration of NCO groups due to elimination of dimeric and polymeric impurities. References 10: 1 Hungarian, 5 Russian, 4 Western.

12172/12955  
CSO: 1841/398



UDC 535.34:547.979.733

STABILITY AND MECHANISM OF DISSOCIATION OF COBALT-TETRAAZAPORPHYRIN COMPLEXES  
IN SULFURIC ACID

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 60, No 9, Sep 86  
(manuscript received 30 Nov 84) pp 2189-2193

[Article by B. D. Berezin, O. G. Khelevina, P. A. Stuzhin and A. V. Glazunov,  
Ivanovo Institute of Chemical Technology]

[Abstract] An analysis was conducted on the effects of tetraaza-substitution in Co-porphyrin complexes via evaluation of the dissociation kinetics of Co-tetraazaporphyrin (I) in sulfuric acid. Spectrophotometric determination of the stability of I was carried out in 70-97%  $H_2SO_4$  at 65 to 138°C. The spectral data were consistent with an initial protolytic dissociation of the protonated complex with the formation of a protonated ligand, followed by ligand destruction. Dissociation was promoted by  $H_3O^+$ , in line with the aquaprotolytic dissociation of metallophthalocyanins. The dissociation reaction was first order in the I complex and second order in the hydroxonium ion, with an energy of activation and entropy of activation of  $64 \pm 3$  kJ/mole and  $-148 \pm 3$  J/mole·K, respectively. Thus, dissociation of I proceeded via a three molecular  $S_{NE}3$  mechanism. Analogous studies were conducted with Co-tetra(tetramethylene)tetraazaporphyrin at 107-137°C in 91-97%  $H_2SO_4$ . In the latter case, the reaction was first order in hydroxonium ion, and the greater stability was ascribed to greater rigidity of the complex and aromaticity. Figures 4; tables 1; references 12: 9 Russian, 3 Western.

12172/12955  
CSO: 1841/54

## URANYL MONOOXALATO-N-ALKYLHYDROXYLAMINATE COMPLEXES

Moscow ZHURNAL NEORGANICHESKOY KHIMII in Russian Vol 31, No 9, Sep 86  
(manuscript received 29 Aug 85) pp 2339-2344

[Article by R. N. Shchelokov, Yu. N. Mikhaylov, A. G. Beyrakhov, I. M. Orlova and Z. R. Ashurov, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, USSR Academy of Sciences]

[Abstract] X-ray structural studies of single crystals of  $(\text{CN}_3\text{H}_6)[\text{UO}_2 \cdot (\text{C}_2\text{O}_4) \{(\text{CH}_3)_2\text{NO}\}] \cdot 0.5\text{H}_2\text{O}$  indicated that the complex has a polymer structure with bis-bidentate bridge oxalate group and bidentate, cyclically coordinated N, N-dimethylhydroxylamine. A structure is suggested for the compound. The structure of the compound was determined by the three-dimensional set of intensities measured by a diffractometer. The crystals of the compound are monoclinic. The structure was solved by the heavy atom method and refined by a full matrix method of least squares in the anisotropic approximation for all 18 nonhydrogen atoms using 2682 independent reflexes on a Nova --1200 minicomputer. Synthesis methods are described. References 6: 5 Russian, 1 Western.

6508/12955  
CSO: 1841/55

PETROLEUM PROCESSING INDUSTRY

UDC 553.982.061.33

OIL AND GAS DEPOSITS PRODUCED BY DEEP STRATA GENERATION

Moscow ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA IM D. I. MENDELEYEVA  
in Russian Vol 31, No 5, Sep-Oct 86 pp 581-586

[Article by V. A. Krayushkin, doctor of geological and mineralogical sciences,  
Institute of Geological Sciences, Ukrainian SSR Academy of Sciences, Kiev]

[Abstract] Soviet and Western literature is reviewed on global gas and oil deposits in terms of stratigraphic data, rock analysis, and oil density. The data indicate that the densities of the crude, on the order of 966-1030 kg/m<sup>3</sup> is consistent with abiogenic synthesis rather than biogenic origins. In this respect, the Fischer-Tropsch reactions appear to represent the fundamental processes responsible for the generation of liquid and gaseous petroleum from carbon monoxide and hydrogen under the conditions of high temperature and pressure prevalent in the subcrustal regions. The contribution of interplanetary dust is brought to bear on primordial hydrocarbon genesis, as well as subsequent events leading to migration pathways of hydrocarbons from source rocks to traps through geologic faults. References 39: 17 Russian, 22 Western.

12172/12955  
CSO: 1841/18

UDC 553.061.3

RETROSPECTIVE ANALYSIS OF THEORIES ABOUT INORGANIC ORIGINS OF PETROLEUM

Moscow ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA IM D. I. MENDELEYEVA  
in Russian Vol 31, No 5, Sep-Oct 86 pp 503-511

[Article by B. M. Valyayev, candidate of geological and mineralogical sciences, Order of the Red Banner of Labor Geological Institute, USSR Academy of Sciences]

[Abstract] Although the theory of the biogenic origins of liquid and gaseous petroleum dominates current thinking, the theory of inorganic origins was

resuscitated by Professor N. A. Kudryavtsev in 1951 and has since gained a number of adherents. It is also interesting to note that the inorganic theory was first advanced by the prescient chemist D. I. Mendelyev, over 100 years ago. Current knowledge, based on drillings as deep as 10 km, are indeed consonant with the view that the pressure and temperature conditions are such as to favor hydrocarbon formation from the action of water on metallic carbides, particularly the iron compounds. Such contentions are also supported by stratigraphic evidence of degassing, i.e., vertical migration of hydrocarbon gas flues. Figures 1; references 116: 107 Russian, 9 Western.

12172/12955  
CSO: 1841/18

UDC 541.12.038:541.128:546.73:542.91:547.21

#### MODERN CATALYTIC SYNTHESIS OF HYDROCARBONS FROM CARBON MONOXIDE AND HYDROGEN

Moscow ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA IM D. I. MENDELEYEVA  
in Russian Vol 31, No 5, Sep-Oct 86 pp 527-532

[Article by Professor A. L. Lapidus, doctor of chemical sciences, Institute of Organic Chemistry imeni N. D. Zelinskiy, and S. M. Loktev, doctor of chemical sciences, Institute of Petrochemical Synthesis imeni A. V. Topchiyev, USSR Academy of Sciences, Moscow]

[Abstract] A review is presented of the current status of hydrocarbon synthesis from CO and H<sub>2</sub> in relation to the catalyst employed and the nature of aluminum silicate support. The most widely used approach in industry relies on the Fischer-Tropsch synthesis, which yields a mixture of aliphatic hydrocarbons with C<sub>1</sub> to C<sub>30</sub>-C<sub>45</sub> backbones. Byproducts include water and a number of other compounds (alcohols, acids, esters, ketones). In general, however, the availability of crude oil has prevented extensive exploitation of the Fischer-Tropsch process in the industrial sector. In distinction to crude oil, the synthetic fuels are virtually free of cyclanes, but do contain olefins. In addition, with the common Co and Fe catalysts, aromatic compounds are not synthesized. The use of high-silicon zeolite catalysts leads to the synthesis of significant quantities of aromatic compounds. Such reactions are conceivable in nature and may account for abiogenic petroleum genesis, with silicates and aluminosilicates with metallic components providing the necessary catalysis under high pressure and temperature conditions. References 53: 37 Russian, 16 Western.

12172/12955  
CSO: 1841/18

## POLYMERS AND POLYMERIZATION

UDC 678.046.3+621.792

### EFFECTS OF FILLERS ON ADHESIVENESS OF INCOMPATIBLE POLYMERS

Moscow KAUCHUK I REZINA in Russian No 9, Sep 86 p 31

[Article by A. V. Savelyev, V. G. Vnukova, V. Ya. Kiselev and I. A. Tutorskiy]

[Abstract] An analysis was conducted on the effects of particle size and chemical nature of surface fillers on adhesiveness of 100 x 120 mm strips of polar SKN-40 (butadiene-acrylonitrile) and nonpolar PIB-200 [sic] polymers. Work of adhesion was tested after 600 sec of contact under a pressure of 15 MPa at 80 to 160°C. Strength of bonding was found to increase in direct proportion to the temperature, and was inversely proportional to particle size of the adhesives (0.06 to 0.18  $\mu\text{m}$ ). The agents tested ranked as follows in effectiveness in promoting bonding of two incompatible polymeric surfaces:  $\text{BaO} > \text{CaO} > \text{MgCO}_3 > \text{kaolin} > \text{CaCO}_3 > \text{BaCO}_3 > \text{MgO}$ . Figures 1; references 6: 5 Russian, 1 Western.

12172/12955

CSO: 1841/65

UDC 678.5016"313"

### PREDICTING USAGE PROPERTIES OF POLYMER MATERIALS

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 86 pp 3-4

[Article by Yu. V. Zelenev]

[Abstract] Two three-stage plans can be used to predict the deformation and strength properties of structural polymer materials. The first plan for predicting the usage life of quasiisotropic polymers in nondestructive deformation includes: intensification of molecular mobility; microstructural changes due to thermal motion of large kinetic units; macrostructural changes, leading to accumulation of residual deformation and irreversible changes in shapes or dimensions. The second plan for prediction of the strength properties of quasiisotropic polymers in quasihomogeneous loading consists of: development of local defects in the material; accumulation of scattered

damages; destruction of the specimen by one of the following mechanisms: brittle failure; failure due to accumulation of a critical number of defects; or failure of the specimen by formation and growth of a crack. The use of scientifically-well-founded methods of prediction, based on quantitative consideration of these plans, allows reduction of the time and material expenditures in the conduct of experimental studies. References 6 (Russian).

6508/12955  
CSO: 1841/37

UDC 678-13:547.538.141.547.391.3'261.01

#### COMPOSITIONAL HETEROGENEITY OF COPOLYMERS OF STYRENE AND METHYLMETHACRYLATE

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 86 pp 42-44

[Article by V. M. Belyayev, S. I. Ganicheva, V. P. Budtov, V. G. Rupyshev and S. Ya. Frenkel]

[Abstract] Styrene-methylmethacrylate copolymers have better optical properties than polystyrene, allowing them to be used in the optical-mechanical industry. This article presents an estimate of the compositional heterogeneity of these copolymers, produced under pilot-plant conditions by rapid sedimentation in the ultraviolet area of the spectrum. The method consists of determining the distribution function of copolymer composition based on data on their sedimentation in solutions with simultaneous recording of the sedimentation boundary by refractometric and absorption-optical systems. The studies established anomalously high compositional heterogeneity of the copolymers, which agrees with data obtained by light scattering methods. This characteristic of the copolymers appears regardless of the method of initiation of copolymerization, method of production of the copolymer and degree of conversion. Figures 3; references 10 (Russian).

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CSO: 1841/37

UDC 678.742.2.01.049

#### PLASTICIZED LIGHT- AND HEAT- RESISTANT COMPOSITIONS BASED ON MEDIUM PRESSURE POLYETHYLENE

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 86 pp 52-54

[Article by A. S. Dzhafarov, T. N. Dzhaililov, Z. G. Topcheva, N. A. Akperov, T. M. Guseynov and I. F. Tomashenko]

[Abstract] A study is reported on the possibility of using inexpensive commercial plasticizers and stabilizers for medium pressure polyethylene. Substances tested included oil refinery wastes and still residues with

softening points of 90-103°C, flash points 195-200°C, plus wastes from the sulfuric acid purification of oil distillates. It was found that residual petroleum asphalt, NKG demulsifier and "neftegaz-4" varnish oil improved the rheological properties and decreased the cost of compositions based on medium density polyethylene, and provided the necessary thermal and light stability. The use of 20% refinery production wastes for this purpose can allow a savings of more than 50 million rubles per year. Figures 3; references 6 (Russian).

6508/12955  
CSO: 1841/37

UDC 677.4:061.3

#### FOURTH INTERNATIONAL SYMPOSIUM ON CHEMICAL FIBERS

Moscow KHIMICHESKIYE VOLOKNA in Russian No 5, Sep-Oct 86 pp 7-13

[Article by E. M. Ayzenshteyn]

[Abstract] The Fourth International Symposium on Chemical Fibers was held on May 27-30, 1986 in Kalinin. The conference was organized by the USSR Ministry of Chemical Industry and the All-Union Chemical Society imeni D. I. Mendeleev. The meeting was attended by more than 600 scientists and specialists, including some 200 representatives of 21 foreign countries. The symposium was organized into five sections which encompassed some 200 papers, and was opened by V. V. Listov, Minister of the USSR Chemical Industry. Every technical, chemical and economic aspect of chemical fibers was touched upon in the talks and discussions, with the final and fully expected conclusion that the future of chemical fibers is indeed bright. The entire proceedings of the symposium have been published in the form of preprints in seven volumes, and made available to all interested parties.

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CSO: 1841/62

UDC 677.4:658.562.011.56

#### FUNDAMENTAL TECHNICAL DECISIONS IN AUTOMATIC CONTROL SYSTEMS OF CHEMICAL FIBER PLANTS

Moscow KHIMICHESKIYE VOLOKNA in Russian No 5, Sep-Oct 86  
(manuscript received 3 Mar 86) pp 14-17

[Article by L. V. Zhuravlev, V. A. Kozlov, A. M. Zyablikov and A. K. Sokolskiy]

[Abstract] A review is presented of the current status of automatic control systems, particularly as they apply to the production of chemical fibers.

The discussion follows the standard agenda of primary elements, sensors, transducers, transmitters, input and return signals, actuating error signals, reference input signals, closed loops, summing points and command setpoints. In the 12th Five-Year Plan, the primary innovation at the chemical fiber plants will be introduction of partial decentralization in the control systems, consisting of three hierarchical levels. The latter will be arranged in a section-department-plant three-tier system resulting, hopefully, in a more responsive operational scheme. Figures 2; references 6 (Russian).

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CSO: 1841/62

UDC 677.463:658.562.011.56

#### INFORMATIONAL SUBSYSTEMS OF AUTOMATIC CONTROL SYSTEMS AT VISCOSE FIBER PLANTS

Moscow KHIMICHESKIYE VOLOKNA in Russian No 5, Sep-Oct 86  
(manuscript received 13 Mar 86) pp 17-20

[Article by A. M. Zyablikov, A. K. Sokolskiy, V. A. Kozlov and T. G. Suris]

[Abstract] A review is provided of information subsystems of control systems at viscose fiber plants, treating them as the key factor in the performance of the overall control system. The information subsystems, consisting as they do of the complex interactions of functional, technical, and program decisions and solutions, provide the basic parameters on which the reliability and stability of an entire control system depends. Two software programs have been developed for the information subsystems -- Impuls and PPP-Information System -- that are expected to find application at viscose fiber plants in the 12th Five-Year Plan. Figures 2.

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UDC 541.182.02

#### SURFACTANT EFFECTS IN MECHANICAL DISPERSION OF FIBER-FORMING POLYMERS

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan 86  
(manuscript received 4 May 85) pp 13-16

[Article by B. L. Khavkina and Ye. V. Safronova]

[Abstract] An analysis was conducted on the effects of surfactants on mechanical dispersion of polymeric materials, since the use of existing polymers affords efficient utilization of polymer production byproducts. Analysis of the effects of a variety of kinetic factors, e.g., temperature, duration, chemical nature and concentration of emulsifying agent, its rate of introduction, etc., demonstrated that the degree of dispersion and the



particle size was dependent on physiochemical characteristics of the polymer. The size of the particles corresponding to the maximum distribution function was shown not to exceed 1  $\mu\text{m}$ , i.e., the colloid particles were commensurate with the supramolecular elements of the polymers in the solid state. Evaluation of the effects of surfactants on the dispersion of polyacrylonitrile, polyethyleneterephthalate, and polyacrylamide showed that the mechanism of action consisted of cleavage, with reduction of the energy of interaction between the supramolecular elements. The following stage of action involved solvation of the resultant colloid particles by the surfactant, leading to structural stability of the dispersion. Figures 3; references 12 (Russian).

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CSO: 1841/398

UDC 677.463.494.675-535.338

#### ACOUSTIC ANALYSIS OF BULKY-PLAITED FIBERS

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan 86  
(manuscript received 13 Jan 84) pp 33-34

[Article by M. P. Nosov, B. Kh. Yunusov, N. K. Tarasenko, T. S. Nazarenko and V. M. Onishchenko]

[Abstract] An attempt was made to analyze combined-fiber characteristics by using an acoustic method, an approach previously unused for such purposes. The study was conducted with a composite fiber consisting of a core filament of polycapromide and a winding viscose filament in terms of sound-wave-propagation and quenching. Evaluation of the velocity of propagation ( $\underline{c}$ ) and the energy attenuation coefficient ( $\underline{a}$ ) demonstrated that longitudinal propagation proceeds only along the central core filament with an anomalously high  $\underline{a}$  in comparison with smooth fibers, due to loop formation by the winding filament. Flexures in the individual elements of the fibers and poor contact between the filaments accounted for the dissipation of the ultrasonic energy as a result of friction between the fibers induced by the propagating sound wave. Application of tension diminishes structural deformities in the fiber leading, as a result, to more efficient ultrasonic transmission and improvements in both  $\underline{c}$  and  $\underline{a}$  values. At maximum stretch  $\underline{a}$  was at a minimum. These observations demonstrated that acoustic methods constitute a viable method for analysis of the physical characteristics of composite fibers. Figures 3; references 3 (Russian).

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## ENHANCING WASH-RESISTANT ANTIMICROBIAL PROPERTIES OF FILLED VISCOSE FIBERS

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan 86  
(manuscript received 7 Aug 85) p 36

[Article by A. M. Gershman, A. D. Virnik, Z. A. Rogovin (deceased),  
G. G. Finger and N. S. Plotkina]

[Abstract] In order to diminish excessive loss of hexachlorophene (HCP) from viscose-based textiles during washing and, therefore, prevent premature loss of antimicrobial properties, chemical modification of the fibers was undertaken to attenuate HCP loss. N,N'-dimethylol ethylene urea (DEU)-treated fibers were found to retain 0.5-0.6% wt% of HCP after 20 soap or OP-7 detergent washings (2.6 wt% initial HCP concentration), with samples of the treated fibers giving 2 mm zones of inhibition against *Staphylococcus aureus*. Untreated fibers showed complete loss of HCP after 10 washings and lacked any activity against the test bacterium. These observations resulted in the identification of DEU as an effective agent in enhancing the antimicrobial characteristics of viscose fibers. In addition to improving the HCP-retaining properties of viscose by effecting cross-linking, DEU may also bind HCP to the fibers. References 6 (Russian).

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## POTENTIAL RESERVES FOR INCREASING SYNTHETIC FIBER PRODUCTION

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan 86  
(manuscript received 11 Sep 85) pp 48-51

[Article by A. A. Fedorenkov]

[Abstract] Soviet production of synthetic fibers has increased twofold from 1975, and new increases in production and improvements in productivity shall depend on scientific and technical innovations. However, one major area of concern that has been identified: the poor quality of machine and equipment used in the production of synthetic fibers. By and large Soviet plants feel the need to upgrade their machinery to the quality standards seen abroad. Retooling is one viable alternative to the purchase of new equipment, with preliminary calculations showing that in the case of polyamide fibers such an approach would be approximately 20% more cost effective than acquisition of new machinery. Further economies can be achieved by a more rational use of raw materials, energy sources, and automation. References 14 (Russian).

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CSO: 1841/398

## AUTOMATIC CONTROL SYSTEM FOR TEMPERATURE-CONTROLLED SHAPING OF POLYCAPROAMIDE FIBERS

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan 86  
(manuscript received 19 Feb 85) pp 55-56

[Article by L. V. Tyurnina, Yu. I. Platov, N. A. Romanova and A. I. Korzhenko]

[Abstract] Cursory description is provided of the MF-1000-KR-18 fiber-shaping device joined in tandem to the spinneret component of KV-III-250-KA fiber-production assembly to illustrate fiber cooling via an automatic control system. Cooling is affected by air flow in the jacket, with sensors located at strategic locations to monitor the temperature of the extruded fiber and air temperature along the path. Temperature control of the inflow air is exercised by A-701-03 automated control system, with the fiber temperature serving as the indirectly controlled variable, and the temperature of the outflow air as the directly controlled variable. Figures 2; references 3 (Russian).

12172/12955  
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## INTERACTION OF EPOXY POLYMERS WITH WATER

Moscow PLASTICHESKIYE MASSY in Russian No 8, Aug 86, pp 9-10

[Article by V. A. Lipskaya, A. M. Ustinova, O. V. Goncharova, Ye. V. Charun, N. M. Pavlova and G. A. Voloskov]

[Abstract] Results are presented from studies of the interaction of water with epoxy polymers obtained by curing epoxydiane and epoxyaniline oligomers with an amine curing-agent. The kinetics of water absorption were studied using cylindrical specimens. The relationship of water absorption with the super-molecular structure was determined by studying the fraction of thermal fluctuation free exchange. The dilatometric behavior and physical-mechanical properties were also studied. Analysis showed that the process of water absorption of the polymers is volumetric and occurs in several stages. In the first stage, water is accumulated in surface microscopic defects. In the second stage, the surface layer of the specimen with denser chain-packing limits water diffusion into the polymer. In the third stage, the process of saturation is accelerated in proportion to the gradient of free volume over the width of the specimen. In the fourth stage, saturation reaches equilibrium. Figure 2; references 3: 1 Russian, 2 Western.

6508/12955  
CSO: 1841/67

## STRENGTH OF ADHESION BOND OF EPOXY POLYMERS MODIFIED WITH BI- AND POLYFUNCTIONAL OLIGOESTERS WITH VARIOUS SUBSTRATES

Moscow PLASTICHESKIYE MASSY in Russian No 8, Aug 86, pp 23-24

[Article by V. M. Kuznetsova, R. A. Yakovleva, V. S. Lebedev, B. G. Dubinskaya and V. V. Yefanova]

[Abstract] A study is made of the influence of the type of reactive oligomer on the technological properties and adhesive bond strength of epoxy polymers with various substrates. The strength of the adhesive bond was determined by the separation resistance. Modification of epoxy polymers with glycidyl ethers increases bond strength, regardless of the substrate. Introduction of acrylic oligomers, not over 20 parts by weight, does not change bond strength, while higher contents decrease it: Bond strength with glass is about half that achieved with steel or aluminum alloy. Changing the content of reactive oligomers and the use of cyanoethylated amine curing-agents can increase bond strength. Figures 2; references 5: 3 Russian, 2 Western.

6508/12955  
CSO: 1841/67

## STABILIZATION OF POLYETHYLENE FILMS BY PHOTOCHEMICAL MODIFICATION

Moscow PLASTICHESKIYE MASSY in Russian No 8, Aug 86, pp 33-35

[Article by V. B. Yakovlev, N. I. Litsov and A. A. Kachan]

[Abstract] A study is made of the possibility of photochemical modification of polyethylene films 100  $\mu$ m thick in the presence of  $\text{PCI}_3$  molecules. High pressure polyethylene was studied with anthraquinone, chloroanthraquinone and naphthoquinone photo initiators. After irradiation, the films became resistant to thermal oxidative destruction, induction time increasing with increasing photosensitizer content from 0.025 to 0.2%. The effect was great when films were irradiated with UV light at  $\lambda > 300$  nm. UV irradiation also produced cross-linking in the films. In the presence of  $\text{PCI}_3$ , the rate of photosensitized cross linking was decreased by 20-30%. The introduction of additional photosensitizer and subsequent modification of the films with  $\text{PCI}_3$  allows production of cross-linked films of great thickness, resistant to thermal oxidative destruction. The functional groups providing stability for the polymer are firmly bonded to the macromolecules and do not migrate from the volume of the film to the surface upon storage or use. References 4 (Russian).

6508/12955  
CSO: 1841/67

## POLYURETHANE COMPOUNDS FOR ELECTRONIC APPARATUS

Moscow PLASTICHESKIYE MASSY in Russian No 8, Aug 86, pp 61

[Article by S. F. Yegorov, V. N. Kuzmin, L. A. Tepteleva, Ye. A. Talutskiy and Yu. F. Tyurikov]

[Abstract] A study is made of the possibility of using elastic polyurethane compounds to decrease resonant oscillations in electronic devices. The mechanical loss angle tangent and dynamic modulus of elasticity were determined by forced resonant oscillation at 200 Hz of a specimen of compound 1 mm thick applied to a steel strip 0.4 mm thick. 3-Layer plates were also tested to determine the effectiveness of the compound in decreasing resonant oscillations of printed circuit boards. It was found that the use of a layer of polyurethane compounds decreased resonant oscillations by a factor of more than three over a broad frequency range without increasing the mass or dimensions of the printed circuit boards. Figure 1; references 3: 2 Russian, 1 Western.

6508/12955

CSO: 1841/67

UDC 678.5.01:532.5

## HYDRODYNAMIC CHARACTERISTICS OF POLYMER MATERIALS

Moscow PLASTICHESKIYE MASSY in Russian No 8, Aug 86 pp 62-63

[Article by B. G. Svishchev, V. K. Gordeyev, M. B. Kozlova, N. A. Kochetkov, M. F. Fonin and A. A. Polovinkina]

[Abstract] An experimental determination of the free-fall velocity of granules of the most common polymers was performed. Particles studied included high pressure polyethylene of two types, glass-filled high-pressure polyethylene, low-pressure polyethylene of two types, a copolymer of ethylene with vinyl acetate, polypropylene, polypropylene filled with talc, polystyrene in two particle sizes and polyethylene terephthalate. The free-fall velocity was determined in an ascending stream of air in a glass tube. Particle-size distributions were analyzed for each group of materials. It was found that the free-fall velocity can be calculated analytically for particles of similar shape and dimensions, using a coefficient determined by simplifying the shape of the granule, while known equations can determine the free-fall velocity of a spherical particle of equivalent diameter. The accuracy of determination of the free-fall velocity and form factor are sufficient for engineering computations used in planning of pneumatic transportation systems. References 5: Russian.

6508/12955

CSO: 1841/67

## SEMICONDUCTOR PROPERTIES OF COMPOSITE MATERIAL BASED ON POLYETHYLENE, RED PHOSPHORUS AND ALUMINUM

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 86, pp 9-10

[Article by V. I. Vasilyev, S. P. Andreyuk and N. M. Tinyakova]

[Abstract] A composite material was obtained by mechanical mixing of polyethylene, aluminum powder and red phosphorus in a porcelain mortar. Tablet specimens were prepared by hot pressing, ten minutes at 120°C, 41.5MPa, containing the same quantity of phosphorus and aluminum as aluminum phosphide, with an excess of phosphorus and with an excess of aluminum powder. The composite materials based on polyethylene and red phosphorus have poor semiconductor properties. The electrical conductivity of the other composites decreases with increasing temperature. The new composite material has semiconductor properties and a broad forbidden zone width, with a higher temperature coefficient of resistivity than other known materials. It is suitable for the manufacture of temperature-dependent resistors. Figure 1; references 5 (Russian).

6508/12955  
CSO: 1841/64

## DETERMINATION OF CONTENT AND HYDROLYTIC STABILITY OF VINYL (2-ETHOXYETHOXY) SILANE ON SURFACE OF DRESSED FIBER GLASS FABRIC

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 86 pp 41-43

[Article by M. B. Krasnopol'skaya, T. L. Ragulina, B. N. Rivkind and V. N. Pak]

[Abstract] Silane dressings are widely used to modify fiber glass fabrics. A study was made of the possibility of determining the content and hydrolytic stability of the silane dressing on the surface of glass fabric by x-ray electron spectroscopy, spectrophotometry and gravimetry using T-11 glass fabric dressed with vinyl (2-Ethoxyethoxy) silane type GVS-9, plus glass fabric with a paraffin emulsion lubricant and glass fabric from which the lubricant was removed by heat treatment at 973K before dressing. Washing with water was found to be virtually as effective as heat treatment in removing the hydrocarbon from the surface of the glass fabric. The dressing was found to be present in excess and to be weakly (nonchemically) bound to the surface of the glass fabric. The hydrolytic instability of the modifying layer can result in poorer properties of the glass fabric-binder interface, particularly when the composite material is utilized in water. Figures 2; references 7: 5 Russian, 2 Western.

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CSO: 1841/64

## PROTECTIVE PROPERTIES OF RADIATION-MODIFIED POLYETHYLENE

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 86 pp 50-51

[Article by N. N. Surnina, L. A. Saltykova, Ye. M. Strochkova and O. F. Tatarenko]

[Abstract] A study was made of the mass transfer of corrosive liquids and gases through polyethylene films modified by radiation surface grafting. Studies were performed on an unstabilized type A film with graft adhesion-active layer based on polymethacrylic acid. The protective properties of the polymer coating in corrosive fluids with low vapor tension were estimated by impedance measurements. Steel specimens with a protective coating of radiation-modified polyethylene film were exposed to 10% sulfuric acid at room temperature. The results indicated that the acid did not penetrate through to the metal surface. The films retain their protective properties and protect the metal from the acid. Radiation modification significantly improves the adhesion of polyethylene to metals without reducing physical and mechanical properties of the polymer. Figure 1; references 5: 4 Russian, 1 Western.

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CSO: 1841/64

UDC 678.5-416.01

## FILM-FORMING POLYMER COMPOSITION WITH ANTIMICROBIAL PROPERTIES

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 86 pp 61-62

[Article by O. V. Luzhetskaya, A. I. Kozharskiy, V. N. Solonin and L. A. Kucherenko]

[Abstract] A study was made of the possibility of using a cyclical ester of butane thiosulfoacid (BTS) as a biocidal additive to polymer materials. The use of 0.2-0.4% BTS prevented development of microorganisms. Although the BTS did not participate in the copolymerization reaction, the biocidal activity of the compound allows it to be used as a biocidal additive in the production of polymer compositions. Introduction of 0.5.3.0% BTS caused practically no change in polymerization rate of monomers except vinyl acetate. A polymer composition with antimicrobial properties was manufactured of polyvinylbutyral, 0.5-3.0% BTS and 5.0-10.0% dibutylphthalate plasticizer in benzene. Figure 1; references 7: 6 Russian, 1 Western.

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CSO: 1841/64

## INCREASING FLAME RESISTANCE OF ALICYCLIC POLYIMIDES

Alma-Ata IZVESTIYA AKADEMII NAUK KAZAKHSKOY SSR: SERIYA KHIMICHESKAYA in Russian No 4, Jul-Aug 86 (manuscript received 12 Feb 86) pp 53-58

[Article by B. A. Zhubanov, S. A. Moshkevich, N. P. Lyubchenko and I. A. Arkhipova, Institute of Chemical Sciences, Kazakh SSR Academy of Sciences, Alma-Ata]

[Abstract] A study was made of polyimides with alicyclic groups in the chain obtained from maleic anhydrides or tricyclodecenetetracarboxylic acids and aromatic diamines. The polymers are flammable, though they have good thermal phosphorus-stability. Several bromine- and phosphorus-containing antipyrene additives which reacted with the terminal groups of the polyimides were studied. The introduction of phosphorus-containing antipyrines to the chain of the alicyclic polyimides, or as mechanical impurities, was found to give the polymers fire retardant properties. References 14: 12 Russian, 2 Western.

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CSO: 1841/20

UDC 541.64:542.954

ADVANCES IN POLYCONDENSATION SYNTHESIS OF HEAT-RESISTANT POLYMERS  
(LITERATURE REVIEW)

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 8, Aug 86 pp 1571-1583

[Article by A. O. Rusanov, Institute of Heteroorganic Compounds imeni A. N. Nesmeyanov, USSR Academy of Sciences]

[Abstract] Soviet and Western literature on polycondensation synthesis of heat stable polymers is reviewed, with special attention to polyimides and polybenzazoles. The various forms (direct, precipitation, reduction) of catalytic synthesis are discussed in some detail, as well as situations in which they are particularly applicable to achieve polyheterocyclization. Developments in the chemistry of polyheteroarylenes led to a large number of heat-resistant heterocyclic polymers, most of which can be classed as polyazoles, polybenzazoles and polybenzazines. One of the most promising developments in polyimide chemistry involved synthesis of polynaphthylimides and polynaphthoylbenzimidazoles, with the latter promising to give rise to a new generation of polyheteroarylenes. In addition, the inexpensive reagent 3,3'-dichloro-4,4'-diaminodiphenylmethane (I) appears to be a valuable precursor of polyimides. Polymers synthesized from I combine excellent solubility in organic solvents with high heat-resistance. Figures 3; references 74: 52 Russian, 22 Western.

12172/12955  
CSO: 1841/40



## SYNTHESIS AND PROPERTIES OF POLYETHYLENE-FLUOROCARBON GRAFT POLYMERS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 8, Aug 86  
(manuscript received 26 Oct 84) pp 1584-1588

[Article by M. K. Asamov, A. A. Yulchibayev, I. Yu. Yakubov and Kh. U. Usmanov,  
Tashkent State University imeni V. I. Lenin]

[Abstract] A study was conducted on the efficiency of radiochemical synthesis of polyethylene-fluorocarbon graft polymers and the chemical and physical characteristics of the resultant copolymers. Comparative evaluation of the kinetics demonstrated that at 273 K and a radiation dose of 0.1 MGy (15.8 Gy/sec), the rate of grafting to polyethylene increased as follows: tetrafluoroethylene > vinylidene fluoride > vinyl fluoride. The rate of grafting was thus directly related to the tendency of the fluorocarbons to undergo homopolymerization. Hydrophobicity of the resultant grafts ranked as follows: polyvinyl fluoride > polyvinylidene fluoride > polytetrafluoroethylene. The radiochemical method was thus shown to be effective in producing polyethylene-fluorocarbon graft polymers showing enhanced heat-resistance, greater tensile strength, improved UV stability, higher flow points and greater hydrophobicity. Figures 7; references 7: 5 Russian, 2 Western.

12172/12955  
CSO: 1841/40

## ELECTROCHEMICAL POLYMERIZATION OF UNSATURATED ISOCYANATE CONTAINING OLIGOMER

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 8, Aug 86  
(manuscript received 26 Nov 84) pp 1676-1680

[Article by T. E. Lipatova, V. G. Matyushova and L. F. Narazhayko, Institute  
of Organic Chemistry, Ukrainian SSR Academy of Sciences]

[Abstract] The first reported electrochemical polymerization was carried out on an unsaturated isocyanate oligomer (I) formed by the reaction of ethylene glycol monomethacrylate with toluylene-2,4-diisocyanate. IR and NMR studies demonstrated that polymerization conducted in dimethyl acetamide over a temperature range of 253 to 313 K resulted in the highest degree (>90%) of polymerization at 293 K with a current of ca. 3.5 mA/m<sup>2</sup>. The process consisted of transformation of the free isocyanate groups into unsaturated bonds and the formation of an insoluble polymer product. In acetonitrile, soluble and insoluble polymer products were formed. The soluble fraction represented a product of 10<sup>3</sup> MW incorporating ca. 40% acetonitrile as comonomer, polymerization of which proceeded along the free isocyanate groups. The second fraction, insoluble in organic solvents, involved conversion of free isocyanate groups and unsaturated bonds. Figures 2; references 3: 1 Russian, 2 Western.

12172/12955  
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RADIATION POSTPOLYMERIZATION OF HYDROXYPROPYL METHACRYLATE DERIVATIZED  
LEVOGLUCOSAN

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 8, Aug 86  
(manuscript received 26 Nov 84) pp 1681-1685

[Article by V. V. Uzmane, O. V. Plotnikov, B. K. Apsite and R. Ya. Pernikis,  
Institute of Wood Chemistry, Latvian SSR Academy of Sciences]

[Abstract] ESR and differential scanning calorimetry were used to monitor radiation postpolymerization of hydroxypropyl methacrylate derivatized levoglucosan samples. The samples were subjected to 2.5 Gy/sec gamma irradiation for a 5 kGy dose at 77 K. Description is provided of the various monomeric radicals formed on the addition of H· to the most hydrated atom in the -C=C- bond, with a maximum degree of conversion of the double bonds ranging from 60 to 75%. The effective energies of activation for the different samples ranged from 32.0 to 44.0 kJ/mole, while the rate constants for chain growth for samples with MW of 543, 715 and 987 were, respectively,  $3.1 \times 10^{-11} \exp(-10500/RT)$ ,  $1.6 \times 10^{-11} \exp(-10000/RT)$ , and  $3.2 \times 10^{-11} \exp(-7600/RT)$  cm<sup>3</sup>/sec. Initiation of polymerization occurred at ca. 100 to 130° below the T<sub>g</sub> value of the oligomers. Chain growth was limited by diffusion factors, while intensive heat release due to postpolymerization occurs after devitrification. Elongation of the hydroxypropyl chains was demonstrated to influence both the physicochemical characteristics of the oligomers and postpolymerization, as a result of looser packing of the oligomer chains and an increase in the number of flexible -C-O-C- bonds in the oligomers. Figures 2; references 5 (Russian).

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FLUORESCENCE QUENCHING OF ORGANIC PHOSPHORS BY OXYGEN IN THIN POLYMERIC  
FILMS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 8, Aug 86  
(manuscript received 1 Dec 84) pp 1692-1696

[Article by G. I. Lashkov (dec.) and A. F. Kavtrev, State Optical Institute  
imeni S. I. Vavilov]

[Abstract] Studies were conducted on PMMA films incorporating 9,10-bis-(phenylethynyl)anthracene (I) to test the utility of fluorescence-quenching by oxygen as a technique suitable for structural studies on thin polymer films. Quenching spectra obtained for 0.5 to 15 μm thick PMMA films containing 0.1 to 10 wt% I following excitation at 350 ± 2 nm with oxygen at pressures of 0 to 25 atm, showed a linear increase in the degree of quenching

with an increase in the partial pressure of oxygen. The oxygen diffusion constant calculated from the quenching data was calculated at  $7 \times 10^{-5}$  cm<sup>2</sup>/sec, and  $5 \times 10^{-8}$  cm<sup>2</sup>/sec when calculated from film saturation data. The differences were interpreted to reflect structural heterogeneity of the PMMA film and migration of the energy of excitation along the phosphor molecules. Comparison of local and volume-average oxygen diffusion constants may be used for ready assessment of structural heterogeneity in the film. Figures 4; references 12: 6 Russian, 6 Western.

12172/12955  
CSO: 1841/40

#### CONTRIBUTION OF SYNTHETIC POLYMERS IN AGRICULTURE

Moscow PRAVDA in Russian 10 Nov 86 p 2

[Article by A. Artyushin, candidate of agricultural sciences, Moscow]

[Abstract] Use of polymers in agriculture is an established fact. The use of polyethylene films for protective covering of foods, plantings, and flowers is a definite contribution to the economy. For the last two decades, polymer use in agriculture has increased tenfold, but the need for polymers is still being satisfied only insignificantly. Soviet production of polymeric materials does not match the world level. The Central Experimental-Research and Construction-Technology Laboratory for Use of Polymers in Agriculture has many enterprises whose effectiveness can be envied. Large-tonnage polymeric material covers and gas-selective (permeable) membranes and packings with calibrated openings in the membranes were proposed by the laboratories. Storage time for vegetables was increased, for fruit, one half to one month, and the inherent waste was decreased fivefold. The taste and nutritional quality of the products were retained. Many developments carried out in laboratories and jointly with institutes and bureaus have been recommended for wide application in agriculture but execution is not apparent. The projected production of covers by membrane technology for 1987 is 30,000 tons for agriculture and 18,000 tons for fruit and vegetables and 100,000 for 1990, but this will not be accomplished. An artificial barrier was placed in the path of polymers because of the absence of the necessary specialized experimental-industrial base. Such a base was considered. Utilization of reserves in the idle production capacity of some industries to produce polymers for new progressive materials was planned. This was stopped on command of the Association of Agricultural Chemistry and it will retard technological progress in the agriindustry. Agriculture will not receive the necessary polymer production. The need for polymeric materials is enormous. Containers, covers, packings, corrosion resistant pipes, long lasting light weight materials, various devices of polymeric materials, polymeric adsorbents, special formulations for dry zones, complex systems for subsurface heating, irrigation and feeding of plants, and other developments were made to advance agro-industry. The position of individuals of the Association of Agricultural Chemists has created barriers to progress in the use of polymers.

12886/12955  
CSO: 1841/48

## DIFFERENTIAL SCANNING CALORIMETRY (DSC) ASSESSMENT OF STRUCTURAL CHANGES IN POLYETHYLENE INDUCED BY IONIZING RADIATION

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 9, Sep 86  
(manuscript received 10 Dec 84) pp 1810-1816

[Article by V. A. Bershteyn, V. M. Yegorov, L. M. Yegorova, V. A. Sirotkina and A. G. Sirota, Physicotechnical Institute imeni A. F. Ioffe, USSR Academy of Sciences; "Plastpolimer" Okhtinsk Scientific Production Association]

[Abstract] SCD was employed in assessing the structural effects of exposing high and low density polyethylene (HDPE; LDPE) to rapid electrons (1.6 MeV) at 293 K under argon. Measurements of heat capacities were conducted at 100-430 K following exposures to doses ranging from 5 to 700 Mrads at 8 Mrad/min. changes in the heat capacities were related to structural elements in unordered regions corresponding to four relaxation states, and the radio-stability of PE crystalline structures. In each case the specific effect of irradiation was due to cross-linking of chain segments with significant segmental mobility, and destructive changes in segments with restricted mobility. Considerable radioresistance was exhibited by crystallites of HDPE, heat treated at 400 K for 20 h, and LDPE, aged under natural conditions for 12 years: little damage was evident even after exposure to a 500 Mrad dose of fast electrons. Moderate 'annealing' of HDPE (5 h at 383 K) imparted moderate stability to the fast electrons. The differences between HDPE crystallites subjected to heat treatment and unheated was ascribed to differences in packing of the chains and, hence, mobility of the segments. Figures 6; references 31: 18 Russian, 13 Western.

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## RESISTANCE TO OXIDATION OF POLYAMIDOIMIDE COATINGS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 9, Sep 86  
(manuscript received 27 Dec 84) pp 1817-1824

[Article by O. A. Ledneva, G. B. Pariyskiy, V. V. Trezvov and D. Ya. Toptygin, Institute of Chemical Physics, USSR Academy of Sciences]

[Abstract] Two polyamidoimide (PAI) films, 20-30  $\mu\text{m}$  thick, were monitored for their oxidation kinetics at 523-673 K, mass loss, and accumulation of macromolecular fragments bearing substituted phenols, in order to determine criteria on which shelflife of varnish coatings could be predicted. Both PAIs (PAI-I formed by reaction of chloroformylphthalic anhydride with 4,4'-diaminodiphenylmethane, or with 4,4'-diaminodiphenyl ether to form PAI-II) yielded complex oxidation kinetics. Over the temperature range

under study (523-623 K for PAI-I; 593-673 K for PAI-II) at relatively low temperatures, the rate of oxygen consumption decreased with time and ceased as oxidizable sites were 'used up'. At higher temperatures (638 K for PAI-I and 673 K for PAI-II), oxidation became autocatalytic and resulted in considerable weight loss. The second stage represented decomposition of the polymers into gaseous products and the formation of insignificant quantities of coke residue. The minimum lifetime for PAI-I coatings at 523 K was estimated at 1896 days (5 years) from the decrease in CH<sub>2</sub> groups, and as 296 days at 553 K. The latter observation underscores the adverse effects of even short-term exposure to high temperatures of PAI coatings designed for industrial application. Figures 4; references 15 (Russian).

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#### EFFECTS OF CARBON FILLER CONCENTRATION ON MOLECULAR MOBILITY AND RELAXATION IN EPOXY RESINS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 9, Sep 86  
(manuscript received 3 Jan 85 ) pp 1842-1847

[Article by O. V. Startsev, Yu. M. Vapirov, I. I. Perepechko and L. P. Kobets]

[Abstract] The techniques of molecular rotation damping and linear dilatometry were used in assessing the effects of carbon filler on molecular mobility and relaxation processes in 5-211B epoxy adhesive (epoxyanilino-phenol-formaldehyde resin). Studies of the parameters of interest over a temperature range of 77 to 573 K for resins with 0 to 66 v% carbon filler demonstrated that the carbon fibers were without significant effect on localized types of molecular mobility. However, the fibers had a marked effect on relaxation processes involving transition of the resin from a glassy state to a viscoelastic state. Studies on the extent to which the carbon fibers affected thermal expansion, demonstrated that the affected region ranged to 5-7  $\mu$ m distance from a fiber. Figures 6; references 9 (Russian).

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## DEGRADATION OF MACROMOLECULES IN FRACTURE OF METAL-POLYMER-METAL STRUCTURES

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 9, Sep 86  
(manuscript received 7 Jan 85) pp 1865-1968

[Article by O. F. Pozdnyakov and V. S. Yudin, Physicotechnical Institute  
imeni A. F. Ioffe, USSR Academy of Sciences]

[Abstract] Mass spectrometry was employed in studies on the degradation of polymethyl methacrylate (PMMA) sandwiched between molybdenum strips in the process of mechanical facturing of the Mo-PMMA-Mo structure. The resultant data demonstrated that the intensity of the mechanical destruction was asymmetrical relative to the plane of the main crack and dependent on the distance between the fracture surface and the interface. The destructive process was accompanied by time-related release of MMA and the formation of free macroradicals represented by terminal  $-\text{CH}_2-\text{C}(\text{CH}_3)(\text{COOCH}_3)$  groups. At 340 to 440 K the latter decompose to the monomeric units, with maximum breakdown occurring at 390 K. The energy of activation for this process is on the order of  $80 \pm 5$  kJ/mole. A direct correlation prevails between the extent to which the PMMA backbone chain is disrupted and the concentration of MMA evolved from the excited macroradicals at the apex of the expanding crack. Figures 2; references 12: 8 Russian, 4 Western.

12172/12955

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## STYRENE POLYMERIZATION ON SURFACE OF ORGANOSILICON PEROXIDE-MODIFIED MINERAL FILLERS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 9, Sep 86  
(manuscript received 17 Jan 85) pp 1908-1913

[Article by N. V. Yablokova, Yu. A. Aleksandrov and O. M. Titova, Scientific  
Research Institute of Chemistry, Gorky State University imeni N. I.  
Lobachevskiy]

[Abstract] Kinetic, thermodynamic and yield data are presented on the polymerization of styrene on the surface of mineral fillers ( $\gamma\text{-Al}_2\text{O}_3$ ,  $\text{CaCO}_3$ , aerosil,  $\text{TiO}_2$ ) modified with organosilicon peroxide initiators (dimethyl-di(tert-butylperoxy)silane, methyltri(tert-butylperoxy)silane, vinyltri(tert-butylperoxy)silane (I), tetra(tert-butylperoxy)silane). Studies over a temperature interval of 70-160°C demonstrated that the concentration of grafted initiator was dependent on the nature of the filler and the initiator, as well as the kinetics of initiator degradation and the attendant energies of activation. Interesting data were obtained with I, demonstrating that pretreatment of the filler surface was not required for polymerization to

occur. At 120°C with I over  $\text{Al}_2\text{O}_3$ , optimal conversion conditions were provided by 0.4-0.5 wt% I in terms of -O-O- (or 2 wt% of styrene content). For grafted I, the energy of activation of polymerization was 32.7 kJ/mole, and, for ungrafted I, 28.5 kJ/mole. Tabulated data are also presented on the impact elasticity and hardness of the resultant polymers formed under different conditions. Figures 2; references 8: 5 Russian, 3 Western.

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UDC 541.64:542.954

#### SYNTHESIS AND THERMAL CHARACTERISTICS OF NOVEL SULFUR BISMALEINIMIDES

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 9, Sep 86  
(manuscript received 25 Jan 85) pp 1925-1933

[Article by V. A. Sergeyev, V. I. Nedelkin, Ye. A. Yuferov, O. G. Nikolskiy, A. A. Askadskiy, G. L. Slonimskiy and B. V. Yorz (Yerzh), Institute of Heteroorganic Compounds imeni A. N. Nesmeyanov, USSR Academy of Sciences; Kemerovo "Karbolit" Scientific Production Association]

[Abstract] Five novel sulfur bismaleinimides were synthesized by the reaction of maleic anhydride with 4,4'-diaminodiphenyl sulfide, 1,4-bis-(4'-aminophenylthio)benzene, 4,4'-bis-(4"-aminophenylthio)diphenyl sulfide, and with telechelate oligophenylenediamine sulfides. The novel compounds were characterized by sulfur-containing aromatic moieties with various distances between the reactive maleinimide groups, and subjected to PMR and IR studies and determinations of thermal features. PMR spectra demonstrated that these products represented an AA'BB' system formed by protons of the aromatic rings. Exothermic peaks on derivatograms indicated that polymerization occurs at temperatures above the  $T_m$  for the crystalline forms and above the  $T_g$  value for the amorphous oligomers. Determinations of the modulus of elasticity, the loss modulus and the tangent of the mechanical loss angle showed that compatibility of these compounds with a polyimide matrix increases with increase in the length of the aromatic fragment in the bismaleinimides. Figures 3; references 20: 14 Russian, 6 Western.

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CSO: 1841/56

USE OF FLOW THEORY IN STRUCTURAL ANALYSIS OF FOAMED POLYMERS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 28, No 9, Sep 86  
(manuscript received 6 Feb 85) pp 1977-1982

[Article by V. K. Gerasimov, V. B. Zlobin and A. Ye. Chalykh, Institute  
of Physical Chemistry, USSR Academy of Sciences]

[Abstract] The flow theory was applied to structural analysis of foamy polyurethane samples, in conjunction with scanning electron microscopy, in order to validate the use of the flow theory in structural analysis of foamed polymeric materials. Evaluation of the results obtained with various polyurethane samples before and after challenge with heat treatment demonstrated that gas permeability studies provided data fully substantiated by morphologic studies, validating the use of the flow theory for such purposes. An increase in the number of defects in pore walls led to a sharp increase in the gas diffusion coefficient, which was based on transition from a diffusion-based to a molecular mechanism of gas translocation in the foam. The latter type of data can be used to ascertain the presence or lack of clusters in the foamed materials. Figures 3; references 11: 9 Russian, 2 Western.

12172/12955  
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UDC 502.55(204):621.039.7

RADIOCHEMICAL DETERMINATION OF STRONTIUM-90 AND CESIUM-137 IN WATERS OF  
THE PACIFIC OCEAN AND ADJACENT SEAS

Leningrad RADIOKHIMIYA in Russian Vol 28, No 4, Jul-Aug 86  
(manuscript received 30 Sep 85; in final form 30 Sep 85 [sic] pp 519-526

[Article by G. S. Borisenko, P. A. Kandinskiy, L. I. Gedeonov, L. M. Ivanova  
and A. A. Petrov]

[Abstract] A method of concentration using difficultly-soluble compounds of carbonates and hexacyanoferrates was used to study the distribution of strontium-90 and cesium-137 in the waters of the Pacific Ocean and adjacent seas. It was found that precipitation could be performed from sea water with salinity of 3.5 to 1.7%. Further decreases in salinity resulted in a shortage of magnesium and calcium and decreased chemical yield of strontium and cesium. Therefore, in waters of low salinity or fresh water, the method of concentration had to be modified, using extraction of cesium as the mixed hexacyano-ferrate with iron introduced for the purpose, strontium as a carbonate together with calcium. The determination showed practically uniform distribution of these nuclides in the northwestern quarter of the Pacific Ocean. The studies in general showed that regions of significant radioactive contamination have developed during certain periods, resulting both from local and from global sources. However, the tremendous volume of the ocean has allowed absorption of the contamination, its dissipation in the deep layers, thus decreasing the concentration of the radioactive nuclides in the surface layer of the ocean. Figures 3; references 17: 6 Russian, 11 Western.

6508/12955  
CSO: 1841/23

STATUS AND TRENDS IN DEVELOPMENT OF WORKS ON PRODUCTION, STUDY OF PROPERTIES AND APPLICATION OF TRANSPLUTONIUM ELEMENTS AT SCIENTIFIC RESEARCH INSTITUTE OF NUCLEAR REACTORS IMENI V. I. LENIN

Leningrad RADIOKHIMIYA in Russian Vol 28, No 4, Jul-Aug 86  
(manuscript received 1 Dec 83; in final form 3 Mar 86) pp 533-539

[Article by V. Ya. Vasilyev, Ya. N. Gordeyev, V. I. Zinkovskiy, Ye. A. Karelin, S. V. Klinov, N. S. Kosulin, V. M. Nikolayev, A. G. Seleznev, G. A. Timofeyev, Yu. G. Toporov and V. A. Tsykanov]

[Abstract] This article outlines work performed between 1976 and 1982 at the Scientific Research Institute of Nuclear Reactors in the area of production, investigation and application of transuranium elements. The major purpose of these studies has been to create an effective technology for production and expand the area of application of these elements in the economy, science, medicine and other areas. Although no radical changes have been made during the period studied, the total knowledge concerning the properties of these elements, their isotopes and compounds and the possible technologies of their production and use have reached a level such that efforts must now be concentrated in areas of application of the elements. Problems for the future include development of processes for production of the transplutonium elements with minimal losses and the development of methods of analysis of the content of fluorine, chlorine, carbon and certain other impurity elements, as well as automation of certain cumbersome processes related to analysis. Figure 2; references 14 (Russian).

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PUTATIVE MECHANISM OF SENSITIZED PHOTOLYSIS OF POLYVINYL ACETATE DERIVED FROM PHOTOSTIMULATED EXOELECTRON EMISSION DATA

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 60, No 9, Sep 86  
(manuscript received 4 Dec 84) pp 2277-2281

[Article by I. V. Krylova and N. V. Grigoryeva, Chemical Faculty, Moscow State University imeni M. V. Lomonosov]

[Abstract] Studies were conducted on the possibility of using photostimulated exoelectron emission (PEE) as a technique for the differentiation of energy transfer due to charge transfer and excitation in polyvinyl acetate (PVA) sensitized with carbazole. The spectral data demonstrated that prolonged UV irradiation with the PVA-absorption wavelength (257 nm) or the carbazole absorption wavelength (325 nm) led to accumulation of stabilized electrons. In the case of PVA, increasing the period of irradiation from

40 to 120 min results in a change in the intensity of the PEE line spectra: a decrease in the 320 nm band, which corresponds to anion radical absorption, and an increase in the 500-550 nm band corresponding to more stable photolytic products. Thus, UV irradiation of PVA leads to electron accumulation in traps formed by intermediate and more stable photolytic products. Addition of carbazole (0.01-5 wt%) and short irradiation (257 nm; 40-80 min) results in diminished PEE intensity, ascribed to carbazole capture of electrons formed in PVA photolysis and its function as a stabilizing agent. With low carbazole concentrations (0.1% wt%) and subsequent 325 nm irradiation, accumulated electrons are emitted at 320-370 nm. These observations, as well as ESR data, demonstrate unequivocally that carbazole may function as a sensitizer and a stabilizer, depending on the photolytic conditions. Figures 5; references 9: 7 Russian, 2 Western.

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UDC 621.373.826

#### MODELING OF CONTINUOUS HF LASER BASED ON OPTICAL RESONANT ENERGY TRANSMISSIONS

Moscow KHIMICHESKAYA FIZIKA in Russian Vol 5, No 8, Aug 86  
(manuscript received 12 Jul 85) pp 1018-1024

[Article by I. M. Beldyugin, Yu. P. Vysotskiy, A. A. Stepanov and V. A. Shcheglov, Institute of Physics imeni P. N. Lebedev, USSR Academy of Sciences, Moscow]

[Abstract] HF lasers based on optical resonant energy transmission are optical converters of resonant laser radiation. The theoretical analysis of such lasers is difficult due to insufficient study of processes of rotational relaxation of HF molecules. In the present work, numerical modeling was performed considering only the most significant and best-studied kinetic processes forming the active medium of the optical converter. The investigation allowed a more detailed study of the amplification properties of the active medium and the energy characteristics of the HF-ORT laser. The variation of efficiency as a function of characteristic parameters of the system was studied and compared with the results of earlier works. The effectiveness of energy conversion in the ORT laser depends on the intensity and spectral composition of the pumping radiation as well as the percent content of HF in the mixture. Efficiency increases with increasing pumping radiation intensity, particularly at energies up to about 0.5KW/cm. The best results are achieved with highly dilute mixtures containing not over 1% HF with single-frequency pumping at low rotational numbers, for which case efficiencies of about 40% or slightly higher can be achieved. Multi-frequency pumping achieves efficiencies of not over 20-30%. Figures 5; references 15: 5 Russian, 10 Western.

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UDC (678.4.033:678.046.312):678.023.32

PRODUCTION OF PULVERULENT ASBESTOS MIXTURES WITH PLOUGH-TYPE MIXER

Moscow KAUCHUK I REZINA in Russian No 10, Oct 86 pp 27-29

[Article by L. M. Lavrova, M. M. Borodulin, O. A. Zakharkin and N. D. Zakharov]

[Abstract] An analysis was conducted on the efficiency of plough-type mixers in producing pulverulent asbestos compositions for brake lining. Trials conducted with mass-produced SKD-SR 1 (TU 38-103284-85) mixture demonstrated that the optimum mixing parameters consisted of 120 rpm for 5 min with the chamber filled to 0.6th capacity. The process followed the common stages consisting of convective and diffusive mixing stages and segregation under the influence of gravity. Basic energy expenditures went for increasing surface contact between the asbestos and rubber components in the mixture. Figures 3; references 8: 7 Russian, 1 Western.

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UDC 678.057;685.314.33

MECHANIZATION OF MANUAL OPERATIONS FOR INCREASING PRODUCTIVITY IN COMPRESSION MOLDING OF BOOTS

Moscow KAUCHUK I REZINA in Russian No 10, Oct 86 pp 32-37

[Article by F. P. Abramovich (deceased), V. S. Nikulin and V. P. Kirchunov]

[Abstract] An analysis was conducted at the various assembly lines involved in compression molding of boots at the "Krasnyy Bogatyr" Production Association to identify operations lending themselves to automation. As a result, automated curing presses were designed and implemented in order to increase productivity, and other operations were similarly mechanized. Although the technical aspects of boot production have been improved and automated, the actual productivity stands at about 80% in comparison with projected figures. To a large extent, failure to meet anticipated productivity derives

from poor work attitude and lack of labor discipline. To that end, further steps are being taken to automate manual operations and to instill a higher sense of the work ethic. Figures 3; references 2 (Russian).

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UDC 678.4.048:669.6

EFFECTS OF ZINC OXIDE AND AROMATIC AMINES ON BINDING STRENGTH OF BRASS-PLATED METAL CORD TO HEXACHLORO-p-XYLENE-TREATED RUBBER

Moscow KAUCHUK I REZINA in Russian No 10, Oct 86 pp 45-46

[Article by N. Khaberland, I. L. Shmurak and V. F. Yevstratov]

[Abstract] The functional effects of zinc oxide and aromatic amine antioxidants were evaluated in terms of the binding strength between brass-plated metal cord (3x0.20+6x0.35) and natural rubber RSS No 3 modified with hexachloro-p-xylene (HCPX). The data showed that zinc oxide should not be reduced below 10 parts/wt because it activates the reaction of HCPX with the rubber. However, the presence of the aromatic amine antioxidants, e.g., diafen FP or naftan-2 [sic], weakens the binding between the metal cord and the rubber and they may, accordingly, be eliminated from the formulation. Figures 1; references 5: 4 Russian, 1 Western.

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UDC 678.065.001.2,002:678.04

18th SCIENTIFIC AND THEORETICAL CONFERENCE ON PROSPECTS IN PNEUMATIC TIRE CONSTRUCTION AND TECHNOLOGY

Moscow KAUCHUK I REZINA in Russian No 9, Sep 86 pp 31-35

[Abstract] The title 18th Scientific and Theoretical Conference was held on December 18-22, 1985 at the Scientific Research Institute of the Tire Industry. The meeting was attended by leading specialists from manufacturing plants and research institutions in Moscow, Voronezh and Omsk, and addressed fundamental developments and advances. The conference concentrated on the need for automation, reliance on mathematical and computerized models and simulations, and more efficient utilization of raw materials in order to produce more reliable tires with longer service periods. Consideration was also given to the need for more efficient utilization and reprocessing of used tires and retreading to expand the supply of tires. Such measures would reduce the cost of automobile transportation by 40-50%. The conference included a presentation of 49 papers, of which 23 are presented in abstract form, and two round-table discussions.

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## RELAXATION CHARACTERISTICS OF RUBBER FIBER COMPOSITES

Moscow KAUCHUK I REZINA in Russian No 8, Aug 86 pp 17-19

[Article by Ye. A. Dzyura and A. P. Naumenko]

[Abstract] A study was conducted on the relaxation characteristics of SKI-3 (synthetic isoprene) rubber filled with P234 carbon and either flexible polyamide (0.027 x 3.3 mm) or rigid glass (0.01 x 0.3 mm) fibers. The tensile strength data were analyzed in terms of the Natting equation,  $\sigma = d\epsilon t^{-m}$ , where  $\sigma$  is the stress in the sample,  $\epsilon$  is the deformation,  $t$  is the time, and  $m$  and  $d$  are empirical constants. These observations demonstrated that evaluation of the changes in  $m$  and  $d$  provide sufficient information on relaxation characteristics of rubber fiber composites to assess their suitability for tire manufacture. An increase in the binding strength between the rubber matrix and the fibers leads to a diminution in the value of  $m$ , which indicates delayed relaxation in the composite material. Fiber orientation has virtually no effect on the value of  $m$ . The value of  $d$ , however, was found to be predicated on the modulus of elasticity and, consequently, demonstrated sensitivity to fiber orientation. Therefore, for composite fibers with slow relaxation the use of flexible polyamide fibers is desirable, along with chemical agents favoring stable bonding between the fibers and the elastomer macro-molecules and the carbon filler. Figures 3; references 4: 3 Russian, 1 Western.

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UDC 678.049.7:661.185.223.2

## ANTIADHESIVE ACTION OF AQUEOUS SOLUTIONS OF "PROGRESS" SURFACTANT

Moscow KAUCHUK I REZINA in Russian No 8, Aug 86 pp 26-29

[Article by A. Ya. Borzenkova, R. I. Dashevskaya, G. K. Tretinnikova and I. A. Semenov]

[Abstract] Since the addition of surfactants to rubber mixtures remains the most effective means of preventing coalescence, a detailed study was conducted to determine the concentration and nature of the surfactant on its efficacy as an antiadhesive agent in SKI-3 and SKS-30 ARKM-15 rubber systems. Studies with Progress surfactant, extensively used in the Soviet tire industry, demonstrated that a concentration of 4% should not be exceeded to prevent coalescence of granulated and flaky rubber materials. Progress consists, for the most part, of sodium sec-alkyl sulfate and contains 4-6%  $\text{Na}_2\text{SO}_4$ . The latter adversely affects adsorption of the surfactant to the rubber surface and the formation of a protective film, and its presence provides the rationale for limiting the use of Progress to 4%. Figures 3; references 10: 1 Polish, 8 Russian, 1 Western.

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QUALITY CONTROL OF RUBBERIZED FABRIC MATERIALS IN TERMS OF HARDNESS DATA

Moscow KAUCHUK I REZINA in Russian No 8, Aug 86 pp 34-35

[Article by Z. D. Orlov, Ye. G. Ustelembova, Ye. I. Semenyuk and L. V. Zavgorodnyaya]

[Abstract] An evaluation was conducted on methods that can be used in the assessment of durability of materials and articles prepared from rubberized fabrics, in order to identify a nondestructive method that can be used for comparative studies. In the final analysis the method covered in GOST 4670-77 (State Standard) met all the criteria for analyzing such materials in terms of hardness. The hardness tester described in GOST 4670-77 has been shown usable with a variety of materials including, in addition to rubberized fabric, polyamide, polyurethane, textolite, and voloknit [sic]. Figures 2; tables 1; references 2 (Russian).

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USE OF ELECTRON ACCELERATORS IN PRODUCTION OF INDUSTRIAL RUBBER PRODUCTS WITH VARIABLE RIGIDITY

Moscow KAUCHUK I REZINA in Russian No 8, Aug 86 p 39

[Article by A. A. Khan, N. N. Bukanova, G. R. Khachatryan and M. Ya. Kryuchkov]

[Abstract] Trials were conducted with the use of accelerated electrons for improving the physicomachanical properties of rubber products subject to mechanical wear, in order to determine the suitability of the process as replacement for more conventional reinforcement techniques in some applications. The test objects consisted of rubber sealing rings subjected to reciprocal motion following exposure to 0.7 MeV electrons from an accelerator, for a total exposure dose of 0.6 MGy. The results showed that irradiation increased the stiffness of the seals to 90-95 Schorr units, the friction coefficient decreased by 25-30%, wear resistance increased 2- to 3 -fold, and liquid seal retention improved 1.5- to 2-fold. The data demonstrated that the improvements achieved by irradiation of the sealing rings were superior to those attained by the more complicated reinforcement processes, demonstrating the utility of accelerated electrons in improving the stiffness of rubber parts. Figures 2; references 3 (Russian).

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METHOD OF ELECTROSMOTIC TRANSFER FOR STUDY OF ELECTROKINETIC PROPERTIES  
OF BAIKAL PULP AND PAPER MILL LIGNIN SLUDGE

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA  
KHIMICHESKIYE NAUKI in Russian, Vol 15, No 5, Sep-Oct 86  
(manuscript received 29 Apr 85) pp 136-139

[Article by Ye. N. Serdobolsky, V. A. Babkin and O. L. Alexeyev, Irkutsk  
Institute of Organic Chemistry, Siberian Department, USSR Academy of Sciences]

[Abstract] The use of an electric field to dewater various objects has long been considered promising. The Baikal Pulp and Paper Mill generates large volumes of water-containing lignin sludge during chemical purification of waste waters, containing 52 to 69% biologically-oxidized sulfate lignin and as much as 16-18% mineral components, proteins, carbohydrates, aliphatic and resin acids. This article studies the electrokinetic properties of the sludge in order to assist in the development of an electroosmotic technology for dewatering the sludge. The electrokinetic characteristics indicate that lignin sludge has high hydrophilicity, causing its low water output, and changing little under the influence of electrolytes. The lignin sludge is a suitable object for dewatering by electroosmosis. This method could be used to develop an effective technology for dewatering at the Baikal Pulp and Paper Mill. Figures 3; references 10: 8 Russian, 2 Western.

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